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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 14, NUMBERS 3 & 4
FEBRUARY 15, 1981

W81-00501 -- W81-00750
CODEN: SWRABW

U.S. DEPARTMENT OF THE INTERIOR
OFFICE OF WATER RESEARCH AND TECHNO

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Volume 14, Numbers 3 and 4 are combined in this issue. Some future issues may also be combined until normal input flow is resumed.

SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the Office of Water Research and Technology,
U.S. Department of the Interior

VOLUME 14, NUMBERS 3 & 4
FEBRUARY 15, 1981

W81-00501 -- W81-00750

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Office of Water Research and Technology. The cumlative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE OFFICE OF WATER RESEARCH AND TECHNOLOGY DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

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07 RESOURCES DATA

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SELECTED WATER RESOURCES ABSTRACTS

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2A. General

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Nevada Univ. System, Reno. Desert Research Inst.
For primary bibliographic entry see Field 6A.
W81-00514

2C. Snow, Ice, and Frost

VARIABLE SOURCES OF SUSPENDED SEDIMENT AND NUTRIENTS FROM SMALL WATERSHEDS,
Max C. Fleischmann Coll. of Agriculture, Reno, NV.
For primary bibliographic entry see Field 5A.
W81-00638

2D. Evaporation and Transpiration

BATHYMETRIC STUDIES ON THE PONGOLO RIVER FLOOD PLAIN,
Natal Univ., Pietermaritzburg, (South Africa).
C. M. Breen, H. D. Furness, J. Heeg, and J. Kok.
Journal of the Limnological Society of Southern Africa (Bloemfontein), Vol 4, No 2, p 95-100, 1978, 5 Fig, 4 Tab, 15 Ref.

Descriptors: *Standing waters, *Flood plains, *Evaporation, *Surveys, *Bathymetry, *Limnology, *Fish farming, Rivers, Surface waters, Lake morphology, Sediments, Thermocline, Water levels, Vegetation, Thermal properties, Ecology, Maps, Sampling, Water loss, Drying, Seasonal, Rainfall, Flood frequency, Flood peak, Fish populations, Sounding, South Africa.

The morphology and ecological characteristics of thirteen of the major pans on the Pongolo River, South Africa, were surveyed and the suitability of various pans for fish production was assessed. During high flood levels (HFL) related to allochthonous inputs, the pans or floodplain basins fill with water and most of the pans retain what has been classified as a maximum retention level (MRL) of water throughout the dry season. Floods inundate about 1000 hectares around the pans. Most of the pans are shallow, less than 2.5 meters deep, yet most of them do not dry out. Depth soundings of the pans were made from an open boat and transferred to 1:600 trignometric survey maps. The floodplain is located in an area where rainfall is seasonal and the evaporative demand is high. Water levels are therefore flood dependent and drop below MRL in the dry season, exposing Cynodon dactyeon which can be used for grazing. Pans with a large volume and shallow depth would be suitable for fish production. (Sidney-IPA)
W81-00734

2E. Streamflow and Runoff

A BASEFLOW SIMULATION MODEL,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
S. E. Hogg, A. G. Thompson, and W. D. Striffler.
In: Proceedings, Watershed Management Symposium. Boise, Idaho, July 21-23, 1980, Vol II, p 755-763, (1980). American Society of Civil Engineers, 345 E. 47th St. New York, NY 10017. OWRT-B-160-Colo(6).

Descriptors: *Base flow, *Model studies, *Streamflow, *Subsurface flow, Simulation analysis, Surface-groundwater relationships, Hydrographs, Watersheds(Basins), Colorado, Rocky Mountains.

A model is presented in which streamflow is simulated at selected arbitrary points along the stream channel. The area of watershed contributing to streamflow between any two points along the channel is defined as a hydrologic response unit. A parameter deck is automatically generated from digital terrain models containing information on topography, vegetation, soils and response unit boundaries. Streamflow contibution is then simulated for each response unit in the watershed. Streamflow is generated according to the dynamic contributing area concept of runoff, incorporating lateral subsurface flow in the channel. The emphasis of the model is on generation of baseflow from groundwater and lateral subsurface flow in the soil. Hydrographs are shown for streamflow in the Williams Fork watershed, near Parshall, Colorado at various points along the channel, as well as for the entire watershed. The model was initially developed for watersheds in the Colorado Rockies but is to be extended elsewhere.
W81-00516

ECOLOGICAL COMPARISON OF INTERMITTENT STREAMS IN DIFFERENT LAND USE PATTERNS IN NORTHEASTERN ILLINOIS,
Louisville Univ., KY. Systems Science Centre.
W. J. Mitsch, and D. A. Urbikas.
University of Louisville, Illinois Institute of Natural Resources, Chicago, Document No 80/17, September 1980. 154 p, 28 Fig, 24 Tab, 65 Ref.

Descriptors: *Illinois, *Intermittent streams, *Watershed management, *Land use, Effects, Streamflow, *Ecosystems, Benthic flora, Benthic fauna, Food chains, Invertebrates, Forecasting, Tubidity, Low-flow frequency.

An assessment of the contribution of intermittent streams is needed since these streams may have a profound effect on the downstream community and the ecology of the larger watershed. Five types of land-use watersheds were chosen: agricultural, residential, industrial, urban/commercial, and forested. The major characteristics of the five streams are presented under physical, chemical and biological headings. Streamflow is the most important physical characteristic; its quantitative value is a direct result of precipitation and soil infiltration. During the 5-month sampling period, water samples, flow measurements and benthic invertebrate samples were taken. Relationships between the benthic invertebrate community and time, streamflow, velocity, stream depth, dissolved oxygen, temperature and turbidity are discussed. The study concludes that a total watershed approach must be involved, including seemingly insignificant intermittent streams, in the study of larger stream systems. Any man-made alterations in flow patterns for these streams must be viewed with this downstream effect in mind as well as the immediate effect on the intermittent stream itself. Small ecosystems cannot tolerate sudden changes, while gradual, cumulative changes can be somewhat unobtrusively passed on to the downstream ecosystem. These effects, however, are often not realized until much damage has already occurred. Preliminary stream energy models were developed from the data and allow for some predictive capacity to prevent irreversible detrimental effects. (Atkins-Omniplan)
W81-00645

ANALYSIS OF STREAM QUALITY IN THE YAMPA RIVER BASIN, COLORADO AND WYOMING,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5B.
W81-00660

LOW-FLOW CHARACTERISTICS OF LOUISIANA STREAMS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
M. J. Forbes, Jr.
Louisiana Department of Transportation and Development, Office of Public Works Water Resources Technical Report No 22, 1980. 95 p, 2 Fig, 1 Plate, 4 Tab, 9 Ref.

Descriptors: *Low flow, *Flow characteristics, *Streamflow, *Louisiana, Gaging stations, Flow measurement, Statistics, Frequency analysis, Correlation analysis, Low-flow frequency, Flow rates, Hydrologic data, Log Pearson type III distribution, Climatic year, Continuous-record stations, Partial-record stations.

This report presents annual and monthly statistics of low flow for 114 streamflow stations in Louisiana for which continuous records of discharge are available and annual statistics for 245 stations (partial record) at which intermittent measurements of low flow have been made. Independent calculations of statistics for continuous-record stations were made using the log-Pearson type III distribution. Statistics for partial-record stations were determined by a regression of discharges at those stations with discharges at continuous-record stations. (USGS)
W81-00665

EVALUATION OF SELECTED DAM-BREAK FLOOD-WAVE MODELS BY USING FIELD DATA,
Geological Survey, NSTL Station, MS. Water Resources Div.
L. F. Land.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-115776, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-44, July 1980. 54 p, 14 Fig, 6 Tab, 19 Ref.

Descriptors: *Floods, *Dam failure, *Model studies, *Mathematical models, Evaluation, Flood forecasting, Flood discharge, Peak discharge, Hydraulic properties, Hydrodynamis, Continuity equation,Momentum equation, Flood routing, *Teton Dam(ID), *Johnstown(PA), *Tocca Falls(GA).

Four dam-break flood-wave models have been evaluated by using three field data sets and selected criteria of desirable features. The models include (1) modified Puls (MP), (2) U.S. Army Corps of Engineers' unsteady flow profiles (USTFLO), (3) National Weather Services' dam-break flood forecast (DBFF), and (4) U.S. Geological Survey's coupled method of characteristics and a general purpose streamflow simulation (M0D-J879DB). The field data sets documented the disasters at Teton Dam, Idaho, Laurel Run, Pa., and Toccoa Falls, Ga. The computed discharges were often within 20% of the observed values with the exception of the simulations at Teton Dam and for a short distance below the dams by the M0C-J879DB. With the same exceptions noted above, the computed flood crests were usually within 2 feet of the observed high-water marks. A modified version of the DBFF model is identified as giving the best results. Overall, it was the most accurate, economical, flexible, numerically stable, easiest to apply, and descriptive of the boundary and flow conditions. (USGS)
W81-00666

FLOOD MAGNITUDE AND FREQUENCY OF STREAMS IN INDIANA: PRELIMINARY ESTIMATING EQUATIONS,
Geological Survey, Indianapolis, IN. Water Resources Div.
R. L. Gold.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, $6.00 in paper copy, $3.50 in microfiche. Geological Strvey Open-File Report 80-759, July, 1980. 44 p, 2 Fig, 2 Tab, 5 Ref.

Descriptors: *Floods, *Flood frequency, *Streams, *Indiana, Illinois, Estimating equations, Regression analysis, Peak discharge, Flood peak, Streamflow, Gaging stations, Sites, Flood recurrence interval, Basin characteristics.

This interim report presents preliminary estimating equations developed for the ongoing study, 'Flood Frequency of Small Streams in Indiana.' The equations were developed by the multiple-regression technique from data collected at 57 crest-stage-gage and 15 rainfall-runoff sites in the study and from 133 streamflow stations in Indiana and 11 in eastern Illinois. Peak discharge was used as the dependent variable, and basin characteristics were used as the independent variables in the analysis. Drainage area and precipitation were the most significant basin characteristics. (USGS)

W81-00667

PREDICTING NORMAL MIMIMUM-FLOW RATES FOR UNGAGED STREAMS IN WEST VIRGINIA,
West Virginia Univ., Morgantown. Water Research Inst.
R. Lee, H. W. Rauch, D. G. Boyer, and E. Snyder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138000, Price codes: A04 in paper copy, A01 in microfiche. Technical Completion Report, 1980. 73 p, 1 Fig, 17 Tab, 67 Ref. OWRT-A-038-WVA(1), 14-34-0001-9052.

Descriptors: *Base flow, Gaging, *Low flow, Low-flow frequency, Mathematical models, Statistical models, *Streamflow forecasting, Climatology, Frequency analysis, Geologic control, Geomorphology, Statistical methods, Synthetic hydrology, Topography, Watersheds(Basins), *West Virginia, *Ungaged Streams.

Comprehensive analyses of a wide range of watershed characteristics were conducted in order to develop deterministic relationships and statistical models for predicting normal minimum flow rates in ungaged West Virginia streams. Preliminary studies demonstrated that the widely used Q7-10 parameter is inherently unstable; its variability for 25-year intervals within a 50-year period of record was about 30% (plus or minus 15%). Water balance computations were significantly improved by the revision of the isohyetal map of normal annual precipitation, and it was shown that derived relationships for normal annual discharge, seasonal flow recession, and seasonal storage fluctuations could be obtained from easily available data. Statistical models incorporating basin area, normal annual discharge, and a seasonal recession constant were effective in estimating Q7-10 with an accuracy as great as the consistency of the variable itself. Of the geologic variables tested, area of carbonate rock was most highly correlated with low-flow parameters (Q7-10 and Q7-2); in eastern West Virginia, carbonate rock exposure is highly correlated with the seasonal recession constant, and may be used interchangeably for low-flow predictions.
W81-00685

MEASUREMENT OF WATER FLOW RATE,
Department of Agriculture, Washington, DC. Office of the Secretary. (Assignee).
J. A. Replogle, A. J. Clemmens, and E. D. Bell.
U.S. Patent No 4,195,519, 6 p, 3 Fig, 13 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 60, April 1, 1980.

Descriptors: *Patents, *Channel flow, *Flow measurement, Flow rates, Water level, Flow control, Equipment.

Water flow rate in channelized, flowing bodies of water is measured by first obstructing the flow of water in the body causing a rise in the water surface upstream from the obstruction. This rise in upstream water surface is communicated to a point above the obstruction and measured there. The measurement is then converted to a water flow rate. A device for measuring water flow rate includes means for producing an obstruction in water flow in the body of water thus causing a rise in the water surface upstream from the obstruction, means for communicating the rise in upstream water surface to a point above the obstruction, and means for measuring the rise at that point, all secured to a frame. (Sinha - OEIS)
W81-00714

2F. Groundwater

ENVIROMENTAL CONTROLS ON OCCURRENCE AND CHEMISTRY OF GROUNDWATER IN A CARBONATE TERRANE OF EASTERN NEVADA,
Fugro, Inc., Long Beach, CA.
C. A. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131112, Price codes: A06 in paper copy, A01 in microfiche. Water Resources Center, University of Nevada, Reno, Publication No 41066, 1980. 101 p, 16 Fig, 6 Tab, 43 Ref, 3 Append. OWRT-B-045-NEV(1), 14-31-0001-3303.

Descriptors: *Groundwater movement, *Groundwater sources, *Geochemistry, *Springs, *Carbonate rocks, Aquifer characteristics, Water quality, Water supply, Arid lands, Groundwater recharge, Snowmelt, Discharge(Water), *Nevada.

Definition of carbonate aquifer characteristics in arid regions is important to a better understanding of water supply sources in Nevada. A description is provided of the identification and interpretation of environmental factors which influence the quantity and chemistry of groundwaters discharging from carbonate terrane in eastern Nevada. Primary controls are geologic structure, mineralogy and physical properties of rocks, and climate. Springs which demonstrate a seasonal cyclic variation in discharge but relatively constant chemistry drain a large-scale area-wide flow system. Amount of snowfall, seasonal temperature, and mineralogy of rocks are most infuluential on solution activity of groundwater, and ultimate chemical quality and discharge of spring waters. (Schulke-Nev)
W81-00637

RESULTS OF COMPUTER MODELING OF GROUNDWATER FLOW - THE CALCIUM CARBONATE AQUIFER OF THE CENTRAL ROSWELL BASIN,
New Mexico Inst. of Mining and Technology, Socorro.
K. R. Rehfeldt.
In: A Quarter Century of Water Research, Proceedings of the Twenty-Fifth Annual New Mexico Water Conference, Apr. 24-25, 1980. WRRI Report No 124, Aug. 1980. p 78-104, 9 Fig, 16 Ref. New Mexico Water Resources Research Institute, New Mexico State University, Box 3167, Las Cruces, NM 88003.

Descriptors: *New Mexico, *Groundwater movement, *Calcium carbonate, *Model studies, Simulation analysis, Transmissivity, Storage coefficient, *Aquifers, Recharge, Infiltration, Precipitation intensity, Tritium, Water distribution, Computer models, Water table.

The flow of groundwater in the Roswell Artesian Basin has been studied since the early 1900's with varied ideas proposed to explain different aspects of the ground-water flow system. The distribution and sources of recharge to the Roswell Basin are delineated using a computer model to simulate groundwater flow in the carbonate aquifer beneath and west of Roswell and in the Glorieta Sandstone and Yeso Formation west of the carbonate aquifer. The effect of precipitation was shown to be small (20%) with deep flow---particularly from the Glorieta Sandstone---appearing to be the major component of recharge. Model parameters include transmissivity, storage coefficient., interaquifer leakage, and recharge. The computer model chosen was a two-dimensional finite-difference model written by Trescott, Pinder and Larson. (Garrison-Omniplan)
W81-00642

STRUCTURE CONTOUR MAP OF THE MADISON GROUP, HAVRE 1 DEGREE BY 2 DEGREE QUADRANGLE, NORTH-CENTRAL MONTANA,
Geological Survey, Billings, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-00652

STRUCTURE CONTOUR MAP OF THE TOP OF THE MADISON GROUP, GREAT FALLS 1 DEGREE BY 2 DEGREE QUADRANGLE, NORTH-CENTRAL MONTANA,
Geological Survey, Billings, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-00653

STRUCTURE CONTOUR MAP OF THE TOP OF THE MADISON GROUP, SHELBY 1 DEGREE BY 2 DEGREE QUADRANGLE, NORTH-CENTRAL MONTANA,
Geological Survey, Billings, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-00654

AQUIFER TESTS OF THE NAVAJO SANDSTONE NEAR CAINEVILLE, WAYNE COUNTY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
J. W. Hood, and T. W. Danielson.
Utah Department of Natural Resources Technical Publication No 66, 1979. 69 p, 18 Fig, 11 Tab, 18 Ref.

Descriptors: *Aquifer testing, Groundwater, *Hydrogeology, *Geohydrologic units, *Aquifer characteristics, Isotropy, Leakage, Hydraulic conductivity, Transmissivity, Storage coefficient, Specific yield, Chemical analysis, Logging(Recording), Hydrologic data, Utah, *Navajo Sandstone, *Wayne County(UT), *Dirty Devil River basin(UT).

The Navajo Sandstone near Cainesville in Wayne County, Utah, is the major aquifer in a section of Mesozoic and Paleozoic sedimentary rocks that is at least 7,160 feet thick. Water in the sandstone is under high artesian pressure. Of two partially penetrating test wells, one yielded 2,800 and the other, 3,110 gallons per minute. The Navajo Sanstone is massive, crossbedded, very fine to fine grained, and approximately 900 ft thick. For the practical purpose, of aquifer analysis, it is hydraulically isotropic in unfractured parts. The average hydraulic conductivity is 0.5 foot per day, and the inferred transmissivity is 450 feet squared per day. Folding has fractured some of the sandstone. The result is enhanced permeability, gross anisotropy of the sandstone, and upward leakage of saline water from underlying formations. Discharging-well tests yield values for transmissivity between 1,330 and 4,250 feet squared per day. Generalized values for transmissivity and storage coefficient that were selected for calculation of long-term pumping effects are 1,500 feet squared per day and 0.001. The specific yield is estimated to be between 5 and 10%. (USGS)
W81-00657

GROUND-WATER HYDROLOGY OF THE DADE CITY AREA, PASCO COUNTY, FLORIDA, WITH EMPHASIS ON THE HYDROLOGIC EFFECTS OF PUMPING FROM THE FLORIDAN AQUIFER,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4B.
W81-00661

RECORDS OF GROUND-WATER RECHARGE AND DISCHARGE, 1934-78; WATER LEVELS, 1975-78; AND CHEMICAL QUALITY OF WATER, 1977-78, FOR THE EDWARDS AQUIFER IN THE SAN ANTONIO AREA, TEXAS.
Geological Survey, San Antonio, TX. Water Resources Div.
Edwards Underground Water District Bulletin 38, July, 1980. 53 p, 4 Fig, 7 Tab, 71 Ref. (Reeves, R. D., Maclay, R. W., Grimm, K. C., and Davis, M. F., compilers).

Descriptors: *Groundwater recharge, *Water yield, *Water level fluctuations, *Water quality, *Aquifers, Water storage, Precipitation(Atmospheric), Drainage area, Observation wells, Data collections, Sites, Water analysis, Hydrogeology, Maps, Texas, *Edwards aquifer(TX), *San Antonio area(TX).

The average annual ground-water recharge to the Edwards aquifer in the San Antonio area, Texas, from 1934 through 1978 was 587,200 acre-feet. The recharge in 1978 was 502,500 acre-feet, ending a trend of above average recharge that began in 1968. A maximum annual recharge of 1,711,200

acre-feet occurred in 1958, and a minimum annual recharge of 43,700 acre-feet occurred in 1956. A maximum annual discharge of 960,900 acre-feet occurred in 1977, and a minimum annual discharge of 388,800 acre-feet occurred in 1955. The maximum annual discharge by wells was 431,800 acre-feet in 1978, which is a record high for the 1934-78 period. Although water levels in wells in the Edwards aquifer showed a general decline in 1978, the volume of ground water in storage in the aquifer was above average. Analyses of water samples from 72 wells and 3 springs show no evidence of significant degradation of water quality in the Edwards aquifer, and the data show no trend of degradation in water quality. (USGS)
W81-00668

2H. Lakes

THE INFLUENCE OF RIVER WATER QUALITY ON STORAGE RESERVOIR MANAGEMENT,
California Univ., Berkeley.
H. B. Fischer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-128688, Price codes: A02 in paper copy, A01 in microfiche. Technical Completion Report, August 1980. 9 p. 8 Ref. W-525.

Descriptors: *Reservoirs, *Surface waters, *Epilimnion, *Hypolimniom, *Rivers, Winds, Meteorology, Water quality, Turbulence, Mixing, Temperature.

Summary of work conducted from June 1977 to June 1980 on numerical modelling used to predict water quality in small- and medium-sized reservoirs. Three aspects of the fluid mechanics of constituent transport to these sized reservoirs are examined in this basic research project: (1) deepening of the epilimnion caused by Kelvin-Helmholtz billowing (Spigel's thesis); (2) mixing in the hypolimnion caused by sidewall turbulence (Ivey's theses); and (3) the effect of unsteady surface winds (Monismith's thesis). The results of part 1 have already been incorporated into the general model, DYRESM; part 2 has just been completed but not yet incorporated into DYRESM; and part 3 is still underway. (Garrison-Omniplan)
W81-00515

SAVING THE LAKES,
Washington State Water Research Center, Pullman.
D. C. Flaherty.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131138, Price codes: A03 in paper copy, A01 in microfiche. Report, June, 1980. 45 p, 27 Fig. OWRT-C-90009-T(No 0415)(1), 14-34-0001-0415.

Descriptors: *Lakes, *Washington, *Water pollution treatment, *Water pollution effects, *Sewage treatment, *Water quality, Pacific coasts region, Water Resources Research Act, Sewage effluents, Water pollution, Pollutants, Ecosystems, Water quality control, Water purification, Natural resources, Water pollution control, Eutrophication, Lake stages.

Washington freshwater lakes had earlier been receiving nutrients and other pollutants that threatened their pristine conditon and has placed several lakes on the verge of eutrophication. Significant developments have since occurred that have enabled significant progress in rehabilitating Washington freshwater lakes. Research studies had involved Liberty Lake, Laker Coeur d' Alene, Lake Washington, Lake Sammamish, Moses Lake, Long Lake, and Newman and Williams Lakes. Lake research is continuing. Sewers and sewage-treatment plants are being constructed to intercept nutrients and other pollutants which formerly entered the lakes unchecked. This document covered separate reports on each of the major Washington lakes. A bibliography of the resulting technical literature has been provided following the discussion of each lake project. Revival of ecological health in Washington lakes has been made possible by the 1964 Water Resources Research Act, Federal and State support of research projects, and increased university student interest and involvement. Specific remedies used to improve lake water quality and ecology were covered. (Zielinski-IPA)
W81-00549

A LIMNOLOGICAL INVESTIGATION OF LAKE LIAMBEZI, CAPRIVI,
National Inst. for Water Research, Pretoria (South Africa).
M. T. Seaman, W. E. Scott, R. D. Walmsley, B. C. W. van der Waal, and D. F. Toerien.
Journal of the Limnological Society of Southern Africa (Bloemfontein), Vol 4, No 2, p 129-144, 1978. 18 Fig, 8 Tab, 52 Ref.

Descriptors: *Lakes, *Limnology, *Biological properties, *Tropic, *Chemical properties, *Physical properties, *Fish management, Turbidity currents, Swamps, Temperature, Surface waters, Sediments, Sampling, Conductivity, Alkalinity, Nitrogen compounds, Phosphorus compounds, Erosion, Erosion control, Algae, Cyanophyta, Silting, Lake basin, Humic acids, Oxygen requirements, Littoral, Vegetation, South Africa, Lake Liambezi(South Africa).

The physical, chemical and biological characteristics of the tropical Lake Liambezi, Caprivi, were studied to determine the fishery potential of the lake and its limnology. The lake is shallow (less than 5 meters) and the depth is fairly constant in the open water. The area of the lake, some 101 square km is surrounded by thick reed swamps and channels, particularly on the south-western shore. Seven sampling stations were established to collect water and bottom samples. High oxygen levels were found at all depths, although photosynthetic activity in the waters was not particularly high. Surface water temperatures ranged from a winter minimum of 15C to a summer maximum of 31C and the pH of the water was fairly alkaline. The conductivity ranged from 17.3 to 41.2 mS per meter. Waters in the reed swamp were brown due to humic substances and high levels of organic nitrogen and phosphorus were also present because of erosion of the lake basin and siltation on the reed swamp side. Planktonic chlorophyll a levels ranged from 1 to 104 microgram per liter with Microcystis as the dominant phytoplankter and the dominant zooplankter was Bosmina. Two new species of blue-green algae were detected. Erosion of the lake basin and the progressive encroachment by Salvinia must be halted if the fishery potential of the lake is to be exploited. (Sidney-IPA)
W81-00551

PLAYA LAKES CHARACTERIZATION STUDY,
Fish and Wildlife Service, Fort Worth, TX.
D. Curtis, and H. Beierman.
Planning aid report to Water and Power Resources Service, September 1980. 56 p, 11 Fig, 13 tab, 27 Ref. 9228/340/06.

Descriptors: *Playas, *Wildlife, *Vegetation, *Limnology, Geomorphology, Land use, Waterfowl, Water resources, Water conservation, Wildlife habitats, Habitat improvement, Agriculture, Wetlands, Persistence, Colorado, Kansas, Oklahoma, New Mexico, Texas, Llano Estacado.

Because of the potential of playa lakes to provide a supplemental water supply for the Southern High Plains, biological and physical data gathered on 116 playas in the Llano Estacado study area are analyzed. The study area includes the southeast corner of Colorado, the soutwest corner of Kansas, the High Plains portion of western Oklahoma, eastern New Mexico, and northwestern Texas. Current land use of playa basins, playa lake persistence, soils, physiography, alterations of playa basins, water quality, wetlands classification, vegetation, wildlife values, historical condition of playas and historical waterfowl use were determined through field observations and landowner interviews. Playas in the study area provide habitat diversity and produce significant numbers of waterfowl. Economic agricultural benefits can be provided through water conservation practices, while maintaining quality wildlife habitat. Wildlife management measures are recommended for playas which allow for agricultural considerations in their implementation. (Moore - SRC)
W81-00554

DYNAMICS OF DISSOLVED OXYGEN DURING ALGAL BLOOM IN LAKE KASUMIGAURA, JAPAN,
Tsukuba Univ., Ibaraki (Japan). Inst. of Biological Sciences.
H. Seki, M. Takahashi, Y. Hara, and S. Ichimura.
Water Research, Vol 14, No 2, p 179-183, February, 1980. 4 Fig, 4 Tab, 14 Ref.

Descriptors: *Aquatic algae, *Dissolved oxygen, *Stratification, *Lakes, *On-site tests, *Respiration, Eutrophication, Photosynthesis, Phytoplankton, Photosynthetic oxygen, Biochemical oxygen demand, Nitrogen, Nutrients, Phosphorus, Hydrogen ion concentration, Adenosine triphosphate, Light intensity, Euphotic zone, Photometry, Japan, Lake Kasumigaura.

The dynamics of dissolved oxygen (DO) during an algal bloom on Lake Kasumigaura, Japan were studied during a 2-day period in August, 1977. Water samples were collected during an algal bloom every 4 hr at Ibaraki Freshwater Fisheries Experiment Station. Oxygen increases due to photosynthesis were measured in situ in a BOD bottle. A darkened bottle was used to measure any respiration occurring simultaneously with photosynthesis. An Aminco Chemo-Glow-Photometer was used to determine adenosine triphosphate (ATP), nitrate, nitrite, ammonium, and reactive phosphorus. Chlorophyll a levels, pH, redox potential, light intensity, bacterial count, and temperature were also monitored. Phytoplankters of the euphotic zone showed no change in vertical distribution during the study period. DO increased in shallower waters above 60 cm after dawn and reached its peak (190% of saturation) at 12:00, gradually decreasing thereafter. Inorganic nutrients exhibited no stratification during the study period. Nitrogen was the controlling nutrient of the algal bloom activity. The increase in DO by photosynthesis was greater than the decrease of DO by respiration at any depth within the euphotic zone. In the hyperoxygenative zone, most of the excess oxygen from photosythesis was liberated from surface waters into the atmosphere or was consumed by microorganisms. The deeper hypooxygenative layer received oxygen from the hyperoxygenative layer. (Geiger-FRC)
W81-00635

REDUCTIONS IN INACTIVATION RATES OF BACERIOPHAGES BY CLAY MINERALS IN LAKE WATER,
New York Univ., NY. Lab. of Microbial Ecology.
For primary bibliographic entry see Field 5G.
W81-00636

ESTIMATED INFLOW AND EVAPORATION FOR GREAT SALT LAKE, UTAH, 1931-76, WITH REVISED MODEL FOR EVALUATING THE EFFECTS OF DIKES ON THE WATER AND SALT BALANCE OF THE LAKE,
Geological Survey, Salt Lake City, UT. Water Resources Div.
K. M. Waddell, and J. D. Barton.
Utah Division of Water Resources Cooperative Investigation Report No 20, 1980. 57 p, 9 Fig, 13 Tab, 5 Ref.

Descriptors: *Model studies, *Great Salt Lake, *Utah, *Water balance, *Salt balance, Hydrologic budget, Saline lakes, Surface waters, Goundwater, Estimating, Inflow, Evaporation, Precipitation(Atmospheric), Dikes, Computer programs, Mathematical models.

A water budget for Great Salt Lake, Utah, was computed with 1-month intervals for the 46-year period of 1931-76. This budget updates previous computations for 1931-73 on the basis of additional data collected during 1974-76. The storage change during each month was computed from a budget of

surface inflow, groundwater inflow, precipitation on the lake surface, a calibration parameter representing the net deficit between the estimated net inflows and the observed net inflows as computed from the observed altitude hydrograph, and outflow from evaporation. Based on additional pan-evaporation data collected at six sites around the perimeter of the lake, estimates of evaporation rates were reduced about 8%. The annual evaporation ranged from about 2.1 to 3.9 million acre-feet and averaged 2.9 million acre-feet. Based on additional surface-inflow data collected during 1974-76, the annual surface inflow to the lake for 1931-76 ranged from 705,200 (1934) to 3,767,000 (1971) acre-feet and averaged 1,926,000 acre-feet. No changes were made to the 1931-73 estimates of precipitation on the lake surface or to the estimate of ground-water inflow. These averaged 870,000 and 75,000 acre-feet per year, respectively. The total annual inflow to Great Salt Lake during 1931-76 ranged from about 1.3 (1961) to 5.0 (1971 and 1975) million acre-feet and averaged 2.9 million acre-feet. (USGS)
W81-00658

TERRESTRIAL-AQUATIC LINKAGES, COMPONENT INTERACTIONS AND POTENTIAL RESTRICTION OF GROWTH OF THE INTRODUCED AQUATIC WEED MYRIOPHYLLUM SPICATUM L. (WATER MILFOIL) I,
Tennessee Univ., Knoxville.
C. C. Amundsen, A Brenkert, and M. C. Bruner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142218, Price codes: A03 in paper copy, A01 in microfiche. Tennessee Water Resources Research Center, University of Tennessee Research Report No 80, April, 1980. 23 p, 1 Fig, 4 Tab, 23 Ref. OWRT-B-042-TENN(1), 14-34-0001-9097.

Descriptors: *Aquatic weed control, *Aquatic weeds, Rooted aquatic plants, *Environmental effects, *Reservoirs, Organic matter, Sediments, Land use, Inflow, Nutrients, Tennessee Valley Authority, *Melton Hill Reservoir(TN), Eurasian Watermilfoil.

Knowledge of plant-sediment interactions is necessary for sound management programs of Eurasion Watermilfoil (Myriophyllum spicatum L.). An investigation of plant and sediment characteristics of TVA Melton Hill Reservoir has been continued in order to further elucidate these relationships. Watermilfoil and sediment samples were collected at five sites in the reservoir. In addition, pre-inundation aerial photographs were examined to determine what the land usage had been under extant watermilfoil beds. Land usage under the five sites sampled and almost all other Melton Hill watermilfoil beds was agricultural. Sediment organic matter, the best overall indicator of nutrient status, varied significantly between sites. Standing crop of watermilfoil also varied significantly with site and with season. A study site in a sheltered embayment had higher sediment organic matter and plant standing crop than the sites in the main reservoir channel. Further detailed nutrient analysis and experimental manipulation in the laboratory is anticipated to more clearly define the relationship of watermilfoil and the sediment.
W81-00687

NITROGEN LOADING: INFLUENCE ON DISSOLVED INORGANIC CARBON IN NATURAL WATERS,
Michigan Univ., Ann Arbor. Div of Biological Sciences.
J. T. Lehman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142226, Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Research, Michigan State University, East Lansing, Project Completion Report, December, 1980. 29 p, 7 Fig, 6 Tab, 28 Ref. OWRT A-109-MICH(1), 14-34-0001-0124.

Descriptors: *Alkalinity, *Inorganic carbon, *Nitrogen loading, *Third Sister Lake(MI), Michigan, Carbonate equilibria, Enclosure experiments, *Lakes, Phytoplankton, Respiration, Photosynthesis, Nitrates, Phosphates, Nutrients.

One of the links between physiological activities of phytoplankton and the dissolved inorganic carbon in natural waters is more subtle than the CO2-producing and CO2-consuming processes of respiration and photosynthesis. When phytoplankton absorb nutrients, particularly inorganic nitrogen, they can alter the alkalinity of the water thereby directly affecting the capacity of the system to retain inorganic carbon in solution. This can lead to large differences in both standing stocks and maximal sustained rates of primary production depending on the chemical form of N that is supplied. The extent of these differences have been examined using enclosures of natural lake water enriched with either ammonium or with nitrate in addition to phosphate. The experimental work is supplemented with analyses of lakes that have experienced severe changes in nitrogen loading.
W81-00688

FACTORS INFLUENCING VIABLE BACTERIA IN A TURBID MAN-MADE IMPOUNDMENT.
Orange Free State Univ., BLoemfontein (South Africa). Inst. of Environmental Science.
D. F. Toerien, D. N. Sadie, and P. Stegmann.
Journal of the Limnological Society of Southern Africa (Bloemfontein), Vol 4, No 2, p 89-94, 1978. 1 Fig, 6 Tab, 21 Ref.

Descriptors: *Aerobic bacteria, *Watersheds(Basins), *Dams, *Microbiology, *Fish farming, Surface waters, Least squares method, Sediments, Silting, Correlation analysis, Littoral, Vegetation, Organic compounds, Turbulence, Nutrients, Floods, Erosion, Suspended solids, Productivity, Management, Biomass, Turbidity, South Africa.

The factors which influence the activity of aerobic bacteria in the waters and sediments of the small silt-laden impoundment, Wuras Dam, South Africa, were studied with regard to possible fish production. Five sampling stations were selected in the impoundment and viable bacterial counts from water and soil samples were obtained. The bacterial counts of the bottom samples did not differ significantly from each other, but were much higher than the surface water samples. A significant positive correlation was obtained for suspensoid concentration and viable bacterial numbers suggesting that water turbulence and allochthonous inputs of suspensoids which may be very high during flood may increase the bacterial numbers. The viable bacterial number per milliliter was given as the regression line of 1854 times turbidity as milligrams Si02 per liter minus 3806. The dense stands of plants such as Phragmites and Typha in the littoral zone of the impoundment probably contributes organic matter on which the bacteria thrive. Based on the surface area and water content of the impoundment, the water and the top 2 cm of sediment could contain 19 and 28 tons of bacterial biomass respectively which could be available for the productivity cycle. The microbiology of turbid impoundment appears to be substantially different from that of clear water systems. (Sidney-IPA)
W81-00733

A CONCEPTUAL MODEL OF A SILTATION SYSTEM IN SHALLOW LAKES WITH LITTORAL VEGETATION,
Chile Univ., Santiago. Facultad de Ciencias.
P. J. Weisser.
Journal of the Limnological Society of Southern Africa (Bloemfontein), Vol 4, No 2, p 145-149, 1978. 5 Fig, 19 Ref.

Descriptors: *Lakes, *Shallow water, *Littoral, *Vegetation, *Silting, *Model studies, Sedimentation, Winds, Coriolis force, Wind velocity, Shores, Atmosphere, Energy, Lake basin, Nutrients, Invasion, Erosion control, Weed control, Distribution, Estimating, Management, Marsh management, Turbidity currents, Austria, Malawi.

The uneven distribution patterns of macrophytes in shallow lakes with littoral vegetation is explained by a conceptual siltation model. Turbulence in a shallow lake caused by strong winds produces erosion of the lake floor and suspension of the silt particles. These silt particles are transported by means of water drift into the littoral vegetation where the silt is deposited. The siltation pattern in Lake Neusiedlersee, Austria, was observed and the prevailing NW winds favored siltation in the southern part of the lake. No silting occurred on the steep eastern shores. The siltation model consists of four elements: the atmosphere, the lake basin, the open water surface, and the littoral vegetation. Energy is supplied to the system by the wind, the Coriolis force due to the rotation of the earth and gravity. Different areas of the lake littoral are unequally favored by the siltation mechanism because of the combination of prevailing winds and the deflection caused by Coriolis force. This results in an uneven distribution of nutrients which foster weed growth. Changes in water-level will affect the whole system of siltation and reeds-wamp advancement. The model explains the distribution of the vegetation in lakes Neusiedlersee (Austria) and Chilwa (Malawi) and suggest management options such as raising the water level, creating steeper shores, and fortifying the lake basin to prevent weed encroachment. (Sidney-IPA)
W81-00739

2J. Erosion and Sedimentation

DEVELOPMENT AND APPLICATION OF A FIELD INSTRUMENTATION SYSTEM FOR THE INVESTIGATION OF SURF ZONE HYDRODYNAMICS,
Woods Hole Oceanographic Institution, MA. Dept. of Ocean Engineering.
M. N. Greer.
Dissertation, No WHOI-80-36, August 1980. 175 p, 6 Fig, 4 Tab, 37 Ref, 2 Append. SG-04-7-158-44079.

Descriptors: *Coasts, *Instrumentation, *Hydrodynamics, Ocean waves, Ocean currents, Current meters, Measurement, Maine, Surf zone, Coastal zone, Nearshore process, Sea Grant Program.

The development and application of an autonomous field instrumentation system consisting of four current meters and four wave gauges, along with a field monitor and digital recorder, is documented. Field measurements of waves and currents at four stations across the width of the surf zone were made; using this system at a beach along the southern coast of Maine. Spilling breakers translated across the surf zone, generated an observed net longshore current during the four hour measurement period. The subsequently analyzed data from this experiment showed a strong longshore current which varied across the width of the surf zone, having a maximum of about 15 cm/sec just inside the breaker line. A net offshore current was observed at all four stations, and averaged approximately 10 cm/sec to 15 cm/sec. Using a simplified force balance model for the generation of longshore currents on a plane, uniform beach, the data was further analyzed to investigate the validity and parameterization of the momentum flux forces and bottom friction forces within the surf zone. There was an observed shoreward loss in momentum flux across the width of the surf zone, from about 150,000 dynes/cm outside the breakers to near zero close to the shoreward extent of the surf zone. (NOAA)
W81-00518

RECONNAISSANCE OF CHEMICAL QUALITY OF SURFACE WATER AND FLUVIAL SEDIMENT IN THE DIRTY DEVIL RIVER BASIN, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 2K.
W81-00659

2K. Chemical Processes

ENVIROMENTAL CONTROLS ON OCCURRENCE AND CHEMISTRY OF GROUNDWATER IN A CARBONATE TERRANE OF EASTERN NEVADA,

Fugro, Inc., Long Beach, CA.
For primary bibliographic entry see Field 2F.
W81-00637

RECONNAISSANCE OF CHEMICAL QUALITY OF SURFACE WATER AND FLUVIAL SEDIMENT IN THE DIRTY DEVIL RIVER BASIN, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
J. C. Mundorff.
Utah Department of Natural Resources Technical Publication No 65, 1979. 132 p, 4 Fig, 3 Plates, 7 Tab, 21 Ref.

Descriptors: *Water quality, *Chemical analysis, *Surface waters, *Fluvial sediments, Streams, Sediment yield, Hydrologic data, Streamflow, Pollutant identification, Water supply, Hydrogeology, Utah, *Dirty Devil River basin(UT), *Upper Colorado River basin(UT).

This water-quality reconnaissance in the Dirty Devil River basin, Utah, covers an area of about 4,300 square miles. Data were obtained by the U.S. Geological Survey one or more times at 104 sites during the period from July 1975 to September 1976. The most pronounced change in chemical characteristics of water in streams in the Dirty Devil River basin occurs in a 15-mile reach of Muddy Creek between the major diversions 5 miles north of Emery and the point at which Highway I-70 crosses Muddy Creek. Dissolved-solids concentrations at the diversions are generally less than 300 milligrams per liter and at the lower end of the reach are commonly greater than 2,000 milligrams per liter. The Dirty Devil River, which is formed by the confluence of Muddy Creek and the Fremont River, has no perennial tributaries. Except during short periods of the thunderstorm runoff in tributaries, the flow is simply a composite of flow from Muddy Creek and the Fremont River. A few data on total coliform, fecal coliform, and fecal streptococci bacteria suggest a general absence of major biological pollution in the basin. Sediment discharge from the upper 1,000 square miles of the Fremont River basin and from the upper 400 square miles of Muddy Creek Basin is a very small part of sediment discharge of the Dirty Devil River. Less than half of the remaining 2,900 square miles of drainage area of the Dirty Devil River probably contributes most of the sediment that is discharged by the streams during a very small part of the time each year. (USGS)
W81-00659

RECORDS OF GROUND-WATER RECHARGE AND DISCHARGE, 1934-78; WATER LEVELS, 1975-78; AND CHEMICAL QUALITY OF WATER, 1977-78, FOR THE EDWARDS AQUIFER IN THE SAN ANTONIO AREA, TEXAS.
Geological Survey, San Antonio, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W81-00668

2L. Estuaries

HOLOCENE GEOMORPHIC EVOLUTION OF A BARRIER-SALT MARSH SYSTEM, SW DELAWARE BAY,
Ankara Univ., (Turkey). Dept. of Geography and Geology.
I. Kayan, and J. C. Kraft.
Southeastern Geology, Vol 20, No 2, p 79-100, March 1979. 15 Fig, 21 Ref.

Descriptors: *Geomorphology, *Estuaries, Barriers, Salt Marshes, *Sedimentology, Aerial photography, *Halocene, *Delaware Bay, Paleogeomorphology, Coastal processes, Sea Grant Program.

Delaware Bay is one of the larger estuaries along the eastern coast of North America. The paleogeomorphology of a portion of the southwest coast of Delaware Bay at Cedar Creek-Slaughter Beach has been delineated from airphoto studies, surface sedimentological and geomorphic studies of present day coastal envoronments, and sedimentological and paleontological studies of subsurface sediments of the latter half of the Holocene Epoch. Radiocarbon data from sedimentary environmental lithosomes clearly indicate that estuarine conditions existed in the study area around 5000 B.P. Studies of the sediments and the shapes of the sedimentary bodies encountered in a drilling program in a small area show that it is possible to make paleogeographic reconstructions of coastal zone environments during the Holocene in the Cedar Creek-Slaughter Beach area. It is possible to predict a rate of coastal erosion of approximately one meter per year in the area, based on observation of ongoing coastal processes and the geologic record of the last half of the Holocene. (NOAA)
W81-00517

DEVELOPMENT AND APPLICATION OF A FIELD INSTRUMENTATION SYSTEM FOR THE INVESTIGATION OF SURF ZONE HYDRODYNAMICS,
Woods Hole Oceanographic Institution, MA. Dept. of Ocean Engineering.
For primary bibliographic entry see Field 2J.
W81-00518

ANTHROPOGENIC INFLUENCE OF THE SEDIMENTARY REGIME OF AN URBAN ESTUARY - BOSTON HARBOR,
Woods Hole Oceanographic Insitution, MA. Dept. of Geology and Geophysics.
M. G. Fitzgerald.
Doctoral Dissertation No WHOI-80-38, September 1980. 299 p, 69 Fig, 14 Tab, 82 Ref, 2 Append. SG-04-7-158-4414, 04-8-M01-149, NA79AA-D-00102.

Descriptors: *Estuaries, *Sedimentation, *Waste disposal, *Water pollution effects, Massachusetts, Tides, Heavy metals, Estuarine environment, Effluents, Cities, *Boston Harbor(MA), Sea Grant Program.

Boston Harbor (and its approches) is a glacially carved, tidally dominated estuary in western Massachusetts Bay. Characterized by low river discharge and significant human impact, the harbor is typical of many bays and estuaries along the New England coast. Modern organic-rich sediments are accumulating in several depocenters at an estimated rate of 0.2-0.3 cm/yr. The high organic matter content (greater than 10%) of these modern sediments is attributed in part of anthropogenic wastes. Wastes rich in trace metals are discharged into the harbor from the sewage treatment facility at Deer Island and from numerous point sources in the Inner Harbor. Trace metal profiles in the bottom sediments reflect the increasing use and discharge of these metals during the past 100 years. Large variations in several cores may be related to circulation changes accompanying the closing of Shirley Gut in 1936. In the water column, silt and clay sized mineral grains are suspended together in organically bound agglomerates. The organic film binding these particles is a by-product of biological activity and aids in the deposition of particulates and pollutants. (NOAA)
W81-00519

WATER QUALITY OF TAMPA BAY, FLORIDA: JUNE 1972 - MAY 1976,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5A.
W81-00662

EXTENSION OF TRANSIENT-FLOW MODEL OF THE SACRAMENTO RIVER AT SACRAMENTO, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. N. Oltmann.
Geological Survey Water-Resources Investigations 80-30, July 1980. 25 p, 13 Fig, 1 Tab, 4 Ref.

Descriptors: *Unsteady flow, *Tidal streams, *Model studies, *Streamflow, Tidal effects, Computer models, Simulaltion analysis, Methodology, Non-uniform flow, Open channel flow, Flow rates, Stream gages, *Sacramento River(CA), Sacramento-Hood tidal reach(CA).

The multiple-reach method-of-characteristics flow-simulaltion model that was successfully applied in 1976 to a 10.8-mile tide-affected reach of the Sacramento River, in California, from Sacramento to Freeport has been extended 10.5 miles farther downstream of Hood. The model reach was extended to improve the quality of the model's output during low-flow conditons for the streamflow station located at the upstream end of the reach, and to provide flow data at additonal sites farther downstream toward the San Francisco Bay system. The extension of the reach, however, has not improved the quality of the model's low-flow output but it has provided flow data for sites farther downstream on the Sacramento River. (USGS)
W81-00663

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

PILOT PLANT STUDY ON MARINE MICROORGANISMS AND ORGANIC MATTER IN SEAWATER DESALINATION BY REVERSE OSMOSIS,
Permutit Co., Inc., Monmouth Junction, NJ.
A. B. Mindler, and S. T. Bateman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131468, Price codes: A07 in paper copy, A01 in microfiche.
Report submitted to Office of Water Research and Technology, May 12, 1980. 130 p, 13 Fig, 2 Tab, 72 Ref, 4 Append. OWRT-C-80316-S(No 8538)(1), 14-34-0001-8538(1).

Descriptors: *Desalination, *Reverse osmosis, *Sea water, *Fouling, Pretreatment, *Marine organisms, *Organic matter, Chlorination, Dechlorination, Bacteria, Oxidation-reduction potential, Corrosion, *St. Croix, Virgin Islands.

A seawater desalination pilot plant was operated for one year under tropical conditions (St. Croix, U.S.V.I.) with emphasis on biological aspects. Pretreatment consisted of chlorination, in-line coagulation with iron sulfate, filtration, dechlorination with excess sodium bisulfite, and alkaline scale prevention by two methods operated in parallel. On-stream time was about 50%. The productivity of the 4 inch duPont B-10 hollow fiber permeator on pH adjusted feed decreased to 765 gpd (74% of projected productivity) in 2700 hours, and to 850 gpd (87% of projected productivity) in 4460 hours on the permeator on antiscalant feed. Rejections were in excess of 98.9 and 99.1%, respectively at 30% recovery. There was an increased amount of biological growth in the antiscalant system on pipelines, tanks and cartridge filters after dechlorination, compared to the acidified system. There was no evidence that this observed biofouling adversely affected either system in reverse osmosis performance. Autopsies performed on two permeators indicated the presence of iron oxide, copper, and silica, but little or no organic fouling. The bacteria counts were reduced by chlorination from about a million cells/ml in raw seawater to about a hundred/ml after filtration, but counts returned to near the original levels after dechlorination. Algae and protozoa were controlled by adding copper sulfate and excluding light. The pretreatment system changed the order of predomination of species of bacteria from a mixed variety to those with enchanced periphytic and slime-producing capability. A submerged glass slide technique was found useful for quantifying the periphytic organisms. TOC levels of 1.0 mg/l were unchanged throughout the pretreatment process.
W81-00639

GRAVITY WASH COLUMN DESIGN, PROCUREMENT, AND INSTALLATION; FOL-

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3A—Saline Water Conversion

LOWED BY DEVELOPMENT TESTS OF THE MODIFIED SINGLE-STAGE DESALTING PILOT PLANT AT WRIGHTSVILLE BEACH, NORTH CAROLINA,
Avco System Div., Wilmington, MA.
R. J. Campbell, and E. W. Duvall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-136897, Price codes: A05 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology (1979). 72 p, 22 Fig, 3 Tab, 7 Ref. OWRT (No 7514)(1), 14-34-001-7514.

Descriptors: *Desalination apparatus, *Desalination plants, *Pilot plants, *Desalination processes, *Separation techniques, Saline water, Treatment, Water treatment, Water purification, Treatment facilities, Equipment, Research and Development, North Carolina, Desalination, Laboratory tests, Testing, Engineering structure, Instrumentation.

This was the final report of a project that covered the design, procurement and installation of a gravity wash column and other modifications to the existing 75,000 gallons per day Crystalex pilot plant located at Wrightsville Beach, North Carolina. Following modifications, development tests were conducted to evaluate plant performance with a gravity wash column. Earlier study had revealed that the large scale 5-foot diameter pressurized counterflow wash column with annular screen design has a number of problems. Use of a new 13-foot diameter gravity wash column design was based on laboratory test data. Laboratory test data and experience also indicated improvements could be made in level controls, pressure transmitters, blow seals, wash water ratio control, and other system areas, and such improvements were incorporated in the Wrightsville plant system. The major pilot plant problem area needing additional design development study annd testing is the configuration of the gravity wash column and its drain screen. Use of warm fluid passages appeared feasible to alleviate screen freezing problems in the pressurized wash column. Other options have been considered. Most of the modified pilot plant system performed reasonably well. Pending improvement for the wash column as outlined could result in the desired performance. (Zielinski-IPA)
W81-00689

3B. Water Yield Improvement

CREATING AND MAINTAINING A POOL OF FRESH WATER ON A TABULAR ICEBERG,
ITI Ltd., Paris (France). (Assignee).
G. L. Mougin.
U.S. Patent No 4,191,491, 4 p, 3 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 992, No 1, p 201, March 4, 1980.

Descriptors: *Patents, *Freshwater, Icebergs, Melt water, Solar radiation, Evaporation, Water sources.

Tabular icebergs can be used as a source of fresh water in arid regions if they are transported from the Antarctic to where there is a need for water. To help reduce the rate at which solar radiation melts the iceberg on its journey, pools of fresh water are maintained on its upper surface, thereby taking advantage of the fact that the latent heat of evaporation of water is about seven times that of fusion of ice. The pools are created by protecting a closed path on the surface of the iceberg from melting by means of flexible sheet material. The protected path then forms the walls of the pool. At its destination the iceberg's pools can be given a V-shaped bottom to help increase the rate at which the iceberg is turned into fresh water. (Sinha - OEIS)
W81-00537

3C. Use Of Water Of Impaired Quality

FIELD EXPERIMENTS ON APPLICATION OF TREATED MUNICIPAL WASTE WATERS TO VEGETATED LANDS,
Tehran Univ. (Iran).
M. Sanai, and J. Shayegan.
Water Pollution Control, Vol 79, No 1, p 126-135, 1980. 4 Fig, 3 Tab, 11 Ref.

Descriptors: *Waste water disposal, *Nutrients, *Crop production, *Return flow, *Irrigation effects, Soil contamination, Sewage treatment, Fertilizer, Alfalfa, Corn, Wheat, Potatoes, Irrigation programs, Impaired water use, Semiarid climates, Crop response.

Field experiments were conducted to determine long term ecological effects of spray irrigating crop land with secondary treated sewage. Chemical analyses of soil, plant tissues, fertilizer, and atmospheric precipitation as well as routine water quality tests were conducted on test plots of alfalfa, corn, potato and wheat over a three-year period. Plots were irrigated either with secondary effluent, freshwater with fertilizer, or freshwater alone. Field productivity and the balance of nitrogen, phosphate, potassium and other nutrients were measured. The crop yields obtained from waste water irrigated plots were consistently higher than yields obtained from waste water irrigated plots were consistently higher than yields from either freshwater irrigated plot. Findings suggest that uniform and gradual nutrient application during irrigation enchances productivity. Corn exhibited the highest productivity and greatest potential for nutrient removal under waste irrigation. A gradual increase in phosphorous concentrations in the soil was observed over three years which suggests possible long term soil pollution and toxicity if nutrient application is not controlled. The irrigation method demonstrates highly efficient nutrient removal and has particular application in semi-arid agricultural areas. (Titus-FRC)
W81-00620

PLANNING REPORT FOR THE IRRIGATION PORTION OF A DUAL WATER SYSTEM FOR WEST JORDAN CITY, SALT LAKE COUNTY, UTAH,
Utah Div. of Water Resources, Salt Lake City.
B. C. Saunders, K. Arthur, and L. Summers.
Report, August, 1980. 33 p, 6 Fig, 1 Ref.

Descriptors: *Utah, *Irrigation design, *Beneficial use, *Municipal water, *Economic feasibility, Water supply, Lakes, *Comprehensive planning, Financial feasibility, Projections, Water demand, Multiple purpose projects, Cost estimates, Task force, Impaired water quality, *Impaired water use, Jordan City area(UT).

As agricultural demand for Utah Lake water in Salt Lake County diminishes because of urbanization, local water management agencies are investigating how the excess low-quality water can be used beneficially. A feasibility analysis was conducted to determine if the water could be used for lawns and gardens. Installing a pressurized irrigation system for lawns and gardens, leaving the present high-quality water for culinary requirements only, would significantly extend the life of the present high-quality water system. West Jordan City was chosen as being representative of the physical and growth characteristics of the southwest quadrant of Salt Lake County. Economic analysis concluded that the new pressurized irrigation system is not feasible at this time unless the price of high-quality water increases. The cost to retrofit present subdivisions to serve the 1980 population of 30,000 and the future growth of West Jordan (for 50 years) is approximately $11,460,000. An increased water charge per 1/4 acre lot would be about $9.50 per month, or $113 per year. A telephone survey concluded that the few residents on a dual irrigation system are satisfied. (Vernale-Omniplan)
W81-00649

3E. Conservation In Industry

STUDY OF THE POTENTIAL FOR WATER REUSE IN THE STEEL INDUSTRY,
Hydrotechnic Corp. New York.
D. D. Ruggiero, H. Hofstein, A. H. Danzberger, J. T. Chu, and M. Strully.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-122673, Price codes: A05 in paper copy, A01 microfiche. Office of Water Research and Techology Report OWRT/RU-80/2, September 1980. 72 p, 8 Fig, 19 Tab, Append. OWRT-C-80141-R (No 8816)(1), 14-34-0001-8816.

Descriptors: *Water pollution control, *Water conservation, *Water reuse, Water quality *Wastewater treatment, Industrial water, Consumptive use, Water management, Industrial wastes, Steel plant wastewater.

This report presents the results of an engineering study of water use in the steel industry in the United States. Water requirements are presented with respect to quality and quanity for the major production processes in integrated steel plants. Water requirements are presented on a national level for iron and steel production in 1977 and anticipated production for the years 1958 and 2000 under three environmental criteria, i.e., those mandated under PL 96-217 of Best Practicable Technology Currently Available (BPT), Best Available Technology Economically Achievable (BAT) and Zero Discharge of Pollutants. It is shown that, to meet these three criteria, increased recirculation of water within integrated steel plants is necessary and, as a result of this recirculation, the quantities of fresh water required is decreased. To improve effluent quality from that attainable under BPT to that attainable under BAT would result in a 38% reduction in fresh water supply required, and when the quality is further improved to zero pollution, the quantity is reduced by an additional 48%, or a total reduction between BPT and zero pollution of 86%. The report describes how increased water reuse within an integrated steel plant may be accomplished and how geographically proximate industries may utilize each other's wastewaters. In attaining the environmental goals, technological and socio-economic stresses result. Research needs to minimize these are described.
W81-00513

WATER CONSERVATION ON THE UPPER MISSOURI AND MISSISSIPPI RIVERS THROUGH THERMAL STANDARDS MODIFICATIONS,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
A. R. Giaquinta, and T. E. Croley, II.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-133704. Price codes: A03 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute, Iowa State University, Ames, Completion Report No ISWRRI-100, September, 1980. 34 p, 7 Fig, 5 Tab, 15 Ref. OWRT-B-061-IA(1), 14-34-0001-8017.

Descriptors: *Water conservation, *Thermal pollution, *Thermal powerplants, *Water quality standards, *Missouri River, *Mississippi River, Mathematical studies, Economics, Economic justification, Economic prediction, Power plants, Heat transfer, Heated water, Water pollution, Water pollution sources, Facilities, Legal aspects, Water temperature.

Twenty existing power plants and other industries and municipalities located along the Missouri and Upper Mississippi River impose thermal loads on the river system. Industrial/municipal sources, due to their low thermal loads relative to power plant head loads, were excluded from this study. All power plants were assumed to operate at 80% capacity factor. Fixed-charged rates of 17.90 and 14.75% were used in the economic analysis of existing and proposed power plants, respectively. Computational procedures were used to compute cooling-related costs of power production and water consumption for changing thermal standards. Coding related power production costs for several different hypothetical thermal standards were computed for all existing/proposed plants. These costs were compared and marginal trade-off relationships were computed. The thermal standards considered were the free-discharge and no discharge standards, the existing standards of the States, and several standards given as temperature

decrements for the existing standard. There would be considerably more heat assimilation capacity in the river using the relaxed standards, providing the ability to size larger future 'permissible' plants at specified locations. (Zielinski-IPA)
W81-00695

KRAFT PULP BLEACHING AND RECOVERY PROCESS,
Scott Paper Co., Philadelphia, PA. (Assignee).
For primary bibliographic entry see Field 5D.
W81-00718

PROCESS AND APPARATUS FOR DEWATERING GRANULATED MATERIAL, ESPECIALLY GRANULATED BLAST FURNACE SLAG,
E. Muller-Spath, K. Muller, H. Kister, W. Schurhoff, and F. W. Hillnhutter.
U.S. Patent No 4,196,078, 8 p, 7 Fig, 1 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 243, April 1, 1980.

Descriptors: *Patents, *Waste water treatment, *Water reuse, Industrial wastes, Water purification, Dewatering, Equipment, Filtration, Blast furnace slag.

A process for dewatering granular bulk material, especially blast furnace slag, which is granulated to sand by the injection of water into the liquid slag stream is described. The slag sand-water mixture is fed to a bucket wheel device, the slag sand is dewatered in perforated scoops of the bucket wheel and fed to a continuous conveyor via a hopper, and the water overflowing from a trough of the bucket wheel device which is contaminated by solids, is clarified. The contaminated water is collected in filter chutes and continuously filtered and then fed to a settling tank for reuse. (Sinha - OEIS)
W81-00720

3F. Conservation In Agriculture

INVESTIGATION OF FACTORS AFFECTING ENERGY FOR IRRIGATION PUMPING,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
A. D. Barefoot.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127557, Price codes: A02 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University Technical Completion Report, September, 1980. 10 p, 2 Tab, 8 Ref. OWRT-A-081-OKLA(1), 14-34-0001-8038.

Descriptors: Irrigation water, *Pumping plants, *Pumping tests, Pumps, *Irrigation wells, *Energy loss, *Efficiencies, Water sources, Water wells, Wells, Irrigation systems, Irrigation practices, Water demand, Irrigation efficiency, Energy budget, Energy, Energy dissipation, Irrigation, Pumping, Consumptive use, Optimization.

Operation efficiency was evaluated for 19 irrigation pumping plants covering five counties in Oklahoma. Most were operated using natural gas; a few using electricity. Most of the irrigation pumps tested were found to be operating at fairly high efficiency levels. Average pump efficiency was found to be about 62%. Newly-installed pumps should operate at near 70% efficiency. Average engine efficiency was found to be about 20%. The average overall pumping efficiency of 13.9% could be increased through better design engineering of pumping plant installations. An efficiency of 15% or higher is desirable. Improved matching of engines to pumps and pumps to well conditions would, in the long term, help reduce irrigation energy use. A rigorous maintenance program coupled to careful matching of engine speed to optimum pump speed could assist final bill reductions for irrigation farmers in the short term. An ongoing program of the type conducted under this study would provide Oklahoma irrigation farmers the means needed to determine the conditions for most efficient operation of their pumping plants. (Zielinski-IPA)
W81-00509

DRIP IRRIGATION SYSTEM FOR AGRICULTURE,
L. E. Sample.
U.S. Patent No 4,191,330, 8 p, 5 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 992, No 1, p 149, March 4, 1980.

Descriptors: *Patents, *Irrigation systems, *Application equipment, Irrigation efficiency, Irrigation practices, Irrigation operation and maintenance, Drip irrigation.

A drip irrigation system comprises water distribution lines extending across a field or similar area for growing crops. The lines are arranged in at least two separate groups, and the lines in each of the groups are interconnected. A source of pressurized, substantially unfiltered water is selectively connected to the lines, and emitters are connected with and spaced along each of the lines for discharging water into the soil. Each emitter has an orifice sized to generally allow foreign material in the unfiltered water to pass through. A water distributor has an inlet portion connected to the water source, and at least two outlet ports each connected to one of the water line groups. A sequencing valve indexes between the first and second ports, and sequencially and individually connected each of the line groups with the water source, whereby surges of water rush through the line to alleviate clogging of the orifices by the foreign material in the water. (Sinha - OEIS)
W81-00538

IRRIGATION PIPE CONTROL SYSTEM,
Colkhi, Inc. San Diego, Ca. (Assignee)
E. F. Jacobi, and M. R. Madden.
U.S. Patent No 4,191,207, 7 p, 5 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 992, No 1, p 108, March 4, 1980.

Descriptors: *Patents, *Irrigation systems, *Control systems, Lateral conveyance structures, Pipes, Instrumentation, Irrigation efficiency, Lasers, Alignment, Phototransducers.

A laser referenced control system for maintaining sequence and correcting the deflections of a moving irrigation pipe includes a laser positioned on a reference coordinate against which the irrigation program sequence and the motion of the pipe are taken. In typical use the pipe is supported on powered wheeled carriages which move across the irrigated terrain at a predetermined rate and it is these wheeled carriages that are controlled according to the deviation of the end of the pipe relative the laser optical axis. This deviation is measured in a fore and aft plane by a phototransducer array to provide the control inputs to the carriages, the vertical terrain undulations being compensated by way of a laser alignment servosystem. In this manner the vertical changes in pipe alignment are taken out, the only correction being made in the plane of translation. (Sinha - OEIS)
W81-00539

AUTOMATIC WIND BRACE FOR SIDE ROLL IRRIGATION SYSTEM,
L. W. Baker.
U.S. Patent No 4,191,206, 7 p, 5 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 992, No 1, p 107-108, March 4, 1980.

Descriptors: *Patents, *Irrigation systems, *Irrigation efficiency, Application equipment, Lateral conveyance structures, Winds, Damage, Irrigation operation and maintenance, Braces.

Wheel supported, side roll irrigation systems may extend for one-half mile or more and are moved by a cental, power-driven mover or a number of such movers. When empty, and therefore quite light in weight, winds of even moderate velocity may cause the wheels to roll relative to the mover, in which case the irrigation pipes become twisted or otherwise damaged. This invention provides for an automatic wind brace which includes an elongated brace member mounted pivotally adjacent its inner end on a base member suported by the irrigation system at a location radially outward of the axis of the supporting wheels, and an extensible damper member pivotally interconnecting the base and brace members for delaying movement of the brace member from its retracted inoperative position placed substantially parallel to the irrigation pipeline, to its extended, operative position projecting angularly downward into engagement of its outer end with the ground. (Sinha - OEIS)
W81-00540

WHEEL RUT CLOSING DEVICE FOR IRRIGATION SYSTEM,
Geobel (Ray) and Sons, Inc., Lebanon, SD. (Assignee).
L. W. Goebel.
U.S. Patent No 4,192,388, 5 p, 6 Fig, 18 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 508, March 11, 1980.

Descriptors: *Patents, *Irrigation systems, Application equipment, Operation and maintenance, Irrigation efficiency, Wheel ruts.

A new and useful device is used in combination with an irrigation system having an irrigation line, and an irrigation line support or supports mounted on a wheel or a number of wheels, to close a wheel rut or ruts created by the wheel or wheels. The wheel rut closing device is mounted on each irrigation line support and generally comprises an implement support frame mounted on the irrigation line support and extending generally rearward of the wheel. A rearwardly trailing implement holder is pivotally connected to the frame and means are carried by the holder for closing a wheel rut or ruts. The frame and the holder can be raised and lowered to the desired height. (Sinha - OEIS)
W81-00541

ARGICULTURAL IRRIGATION SYSTEM AND COMPONENTS THEREFOR,
CH20, Inc., La Grande, OR. (Assignee).
B. Courtright.
U. S. Patent No 4,192,340, 12 p, 13 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 490, March 11, 1980.

Descriptors: *Patents, *Irrigation systems, *Hydraulic systems, Application equipment, Operation and maintenance, Irrigation efficiency, Booster units.

An agricultural irrigation wheel line is provided having a line translational propulsion unit and also a series of torque assist or torque booster units spaced along the line. All of the units are preferably hydraulically driven by water pressure in the irrigation line itself. The master unit is generally provided a coupling, for the hose to be dragged over the field and coupled to a water-pressure source. Both the master and the booster units are coupled to and driven by line pressure in the wheel line, supplying pressured water for spray equipment carried by the line, advancing the line and torquing the same. Controls are provided the units for regulating the stall-out condition of each unit. The units speed up, slow down, or stall out, automatically in response to an undesired line condition, i.e. deflection or deviation from the essential rectilinear condition desired. The same applies to the booster units coupled to mutually spaced points along the line. (Sinha - OEIS)
W81-00542

GUIDANCE SYSTEM FOR IRRIGATION SPRINKLING APPARATUS,
N. S. Standal.
U.S. Patent No 4,192,335, 15 p, 30 Fig, 17 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 488, March 11, 1980.

Descriptors: *Patents, *Irrigation systems, *Sprinkler irrigation, Application equipment, Hydraulic systems, Operation and maintenance, Irrigation efficiency, Guidance systems, Risers.

A sprinkling apparatus is powered for movement along a row of spaced risers. It is guided along a

path parallel to the risers without any physical guidance being provided in the spaces between them. A coupler engages each successive riser and selectively completes a hydraulic circuit between the riser and the sprinkling apparatus. Mechanical indexing and engagement of the coupler relative to the riser is used as a guide for modifying the direction of movement of the sprinkling apparatus in order to permit engagement of the next successive riser by the coupler. All functions of the sprinkling apparatus are automatically sequenced upon engagement of selected risers. Alternate risers can be skipped. Reversal of the sprinkling apparatus can be achieved by placement of stop mechanisms along the row of risers. (Sinha - OEIS)
W81-00543

HIGH CAPACITY SPRINKLER HEAD WITH IMPROVED BRAKE MECHANISM,
Nelson Irrigation Corp., Walla Walla, WA. (Assignee).
L. P. Meyer.
U.S. Patent No 4,193,548, 8 p, 5 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 992, No 3, p 802, March 18, 1980.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, Irrigation operation and maintenance, Application equipment, Irrigation efficiency.

A step-by-step rotary sprinkler head is comprised of a stationary annular housing assembly, an annular mounting member supported within the upper end portion of the housing for rotational movement about a generally vertically extending axis. The mounting member has three sets of equally spaced holes extending vertically. An annular brake member has a set of equally spaced stub shafts extending vertically which slidably engage within one set of holes. The annular brake member has a downwardly facing annular brake surface which engages a fixed upwardly facing brake surface provided by the housing. A sprinkler body assembly is carried by the mounting member and is fixedly secured by bolts. A series of coil springs is mounted within a third one of the sets of holes to resiliently urge the interengaging brake surfaces together with a constant spring force. (Sinha - OEIS)
W81-00544

FLOW CONTROL VALVE FOR SUBSURFACE IRRIGATION SYSTEM,
S. Riusech.
U.S. Patent No 4,193,711, 4 p, 5 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 992, No 3, p 956, March 18, 1980.

Descriptors: *Patents, *Irrigation systems, *Subsurface irrigation, Flow control, Application equipment, Irrigation efficiency, Irrigation operation and maintenance, Valves.

The invention provides an improved flow control valve structure for use in a subsurface irrigation system. It is designed to control the water flow characteristics of the system so that generally the water distribution is similar throughout the field in the sense that one portion is not overwatered excessively in relation to other portions of the field. The valve includes a foot with a pair of oppositely facing laterally opening holes. The foot is sized to extend through the hole in the bottom surface of a pipe of the system and has an upstanding leg of flexible material to be received within the pipe in a flexed condition. The leg has a longitudinal passageway to deliver fluid flowing in the pipe to the holes in the foot; to the leg, a flexible tube extension is fitted to extend within the pipe and which is of a preselected length, to present predetermined resistance to the water flow, so that the distribution from the system may be generally equalized by selecting the proper length tube extension. (Sinha - OEIS)
W81-00545

AGRICULTURAL WATER USE AND COSTS IN CALIFORNIA,
California Univ., Berkeley.
A. Highstreet, C. F. Nuckton, and G. L. Horner.
University of California, Giannini Foundation of Economics, Information Series 80-2, Division of Agricultural Sciences Bulletin 1896. July, 1980. 41 p, 1 Fig, 5 Tab, 11 Append.

Descriptors: *California, *Water costs, *Crop production budgets, *Irrigation systems, Agricultural watersheds, Application methods, Regional analysis, Water resources development, Field crops, Surface water, Groundwater, Economic evaluation, Drought tolerace.

Eighty-five percent of water used in California initially goes to agriculture; the remainder to municipalities and industries. Predominant regional crops were determined using the County Agricultural Commissioner's 1975 acreage basis in three categories: field crops, fruits and nuts, and vegetables. Interviews with University of California Cooperative Extension county farm advisors in 1979 were the primary source of information on water sources (ground or surface) and application methods used for each regional crop. Estimated regional irrigation costs for each crop are differentiated by water source, application rate, and irrigation method in 13 production regions of California. Application rates vary from region to region for the same crop due to differences in climate, soil type, and the availability and cost of water. Computer modeling was used to determine crop production budgets. Future changes in water use may be necessitated by competing demands for water, increasing water costs, or diminished water quality or quantity. (Vernale-Omniplan)
W81-00644

AUTOMATIC CONTROL OF THE MOISTURE CONTENT OF THE SOIL,
L. H. Birnbach, and C. A. Birnbach.
U.S. Patent No 4,194,691, 10 p, 10 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 992, No 4, p 1286, March 25, 1980.

Descriptors: *Patents, *Irrigation, *Soil moisture, *Control systems, Moisture content, Water delivery, Irrigation efficiency, Water requirements, Automatic control.

The moisture content of the soil in each of a number of areas is maintained between predetermined wet and dry thresholds by a control having circuits operative in response to detected thresholds through contacts inserted in the soil to effect the opening and closing of a valve in the conduit by which water is delivered to that area. Typically a number of conduits are connected directly or through junctions to a common water supply and where that supply is pump controlled, the control for each conduit includes circuitry that enables a switch in the pump circuit to be closed whenever the valve operated by that control is open. (Sinha - OEIS)
W81-00708

IRRIGATION EMITTER SYSTEM,
E. Schopp.
U.S. Patent No 4,194,695, 4 p, 2 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 992, No 4, p 1287, March 25, 1980.

Descriptors: *Patents, *Irrigation, *Application equipment, Irrigation efficiency, Irrigation operation and maintenance, Emitters, Drip irrigation.

An irrigation emitter system utilizes a tubular adapter member which is formed of non-rigid plastic material. Self-sealing coupling plugs are connected through the wall surfaces of the adapter member to couple liquid from the adapter member to outlet tubes. A pressure reducing mechanisms is formed in the adapter member for enabling the plugs to be coupled directly to the tubes for distribution of the liquid. The invention eliminates the need for utilizing a drip regulator emitter intermediate the distribution hoses and the pressure regulated adapter and uses a relatively simple pressure member enabling self-sealing coupling plugs to interconnect the flexible distribution hose directly to the adapter. (Sinha - OEIS)
W81-00709

SELF-PROPELLED IRRIGATION APPARATUS,
Moulton Irrigation Co., Somerset, WI. (Assignee).
D. C. Scholz.
U.S. Patent No 4,195,781, 12 p, 12 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 150, April 1, 1980.

Descriptors: *Patents, *Irrigation systems, Sprinkler irrigation, Control systems, Irrigation operation and maintenance, Irrigation efficiency, Self-propelled irrigation system.

A self-propelled irrigation apparatus has a main pressurized water distribution pipe with its inner end pivotally supported at a central supply pipe and radially extending distribution pipe sections which have swinging connections with each other. It has a mobile support at the outer end of a section, a water reaction spray motor for driving each mobile support and a diaphragm-operated 'on-off' motor control valve connecting the motor to the distribution pipe. A pilot valve selectively connects a pressure control chamber at one side of the control valve diaphragm with either the pressurized water in the pipe or with a pressure relief opening in response to predetermined relative swinging movement of the pipe sections. The apparatus also has one or more controllable irrigation sprinkler units connected to the distribution pipe by a separate diaphragm operated 'on-off' sprinkler control valve at a location spaced from the reaction motor. The sprinkler control valve has a similar pressure control chamber connected to the same pilot valve for simultaneous 'on' or 'off' control of the reaction motor and sprinkler unit. (Sinha - OEIS)
W81-00715

METHOD AND DEVICE FOR ENHANCING THE DISTRIBUTION OF WATER FROM A SPRINKLER OPERATED AT LOW PRESSURES,
Rain Bird Sprinkler Mfg. Corp., Glendora, CA. (Assignee).
E. M. Troup.
U.S. Patent No 4,195,782, 5 p, 3 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 150, April 1, 1980.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, Application equipment, Irrigation operation and maintenance, Irrigation efficiency, Nozzles.

A new and improved nozzle and method of operation for use in irrigation sprinklers of the impact and reaction drive types is described. Water may be evenly distributed over the range of the sprinkler even when operating at relatively low supply pressures. This is accomplished generally by a nozzle which separates the stream of water flowing through the sprinkler into at least two separate and distinct streams of water, and directs these distinct streams so that they intersect at a predetermined angle after being ejected from the nozzle. On intersection of the streams, the resultant stream is broken into sufficiently small droplets to provide the desired distribution of water by the sprinkler. (Sinha - OEIS)
W81-00716

THREE LAYER IRRIGATION TUBE AND APPARATUS AND METHOD FOR PRODUCING SAME,
G. Gilead.
U.S. Patent No 4,195,784, 9 p, 16 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 151, April 1, 1980.

Descriptors: *Patents, *Irrigation systems, Water delivery, Irrigation operation and maintenance, Irrigation efficiency, Equipment, *Drip irrigation.

A drip irrigation apparatus comprises a first, second and third layers of sheet material, the layers of material being elongate and arranged so that their side edges lie in confronting and coextensive arrangement. The first, second and third layers are joined to each other at their side edges to define a water supply passage between the first and second

layers and to define a water discharge passage between the second and third layers. The second layer is apertured to provide fluid communication between the water supply passage and the water discharge passage. A method and apparatus for producing the drip irrigation apparatus is also provided. (Sinha-OEIS)
W81-00717

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

A BIBLIOGRAPHY OF STREAM ALTERATION (CHANNELIZATION),
Clemson Univ., SC. Dept. of Entomology and Economic Zoology.
For primary bibliographic entry see Field 10C.
W81-00546

TERRESTRIAL-AQUATIC LINKAGES, COMPONENT INTERACTIONS AND POTENTIAL RESTRICTION OF GROWTH OF THE INTRODUCED AQUATIC WEED MYRIOPHYLLUM SPICATUM L. (WATER MILFOIL) I,
Tennessee Univ., Knoxville.
For primary bibliographic entry see Field 2H.
W81-00687

MEASUREMENT OF WATER FLOW RATE,
Department of Agriculture, Washington, DC. Office of the Secretary. (Assignee).
For primary bibliographic entry see Field 2E.
W81-00714

4B. Groundwater Management

MANAGEMENT OF THE HYDROLOGIC SYSTEM IN AREAS SUBJECT TO COAL MINING ACTIVITIES,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 5G.
W81-00502

DETERMINATION OF WATER SATURATION IN SUBSURFACE EARTH FORMATIONS ADJACENT WELL BOREHOLES,
Texaco Inc., White Plains, NY. (Assignee).
H. D. Scott.
U.S. Patent No 4,191,884, 7 p, 6 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 992, No 1, p 317, March 4, 1980.

Descriptors: *Patents, *Borehole geophysics, Geologic formations, Water sources, Salinity, Gamma rays, Aquifer testing.

Gamma ray spectra of earth formation surrounding a well borehole are obtained by bombarding the formations with neutrons from a pulsed neutron source and detecting the gamma rays resulting from capture of thermalized neutrons in the formation using a germanium gamma ray detector. A measure of the ratio of chlorine to hydrogen is obtained from the detected gamma radiation spectra, and the apparent formation water salinity is determined from the chlorine/hydrogen ratio. The water saturation of the formation is then obtained from the apparent formation water salinity and the true formation water salinity. Compensation is made for the presence of saline water in the borehole fluid and in the cement annulus, as well as for any bound water in the formation. (Sinha - OEIS)
W81-00536

GROUND-WATER HYDROLOGY OF THE DADE CITY AREA, PASCO COUNTY, FLORIDA, WITH EMPHASIS ON THE HYDROLOGIC EFFECTS OF PUMPING FROM THE FLORIDAN AQUIFER,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. H. Tribbals, W. Anderson, and C. P. Laughlin.
Geological Survey Water-Resources Investigations 80-33, 1980. 64 p, 34 Fig, 4 Tab, 38 Ref.

Descriptors: *Groundwater, *Hydrogeology, *Deep-well pumping, *Drawdown, *Florida, Water supply, Aquifer characteristics, Water wells, Well data, Groundwater recharge, Potentiometric level, Transmissivity, Storage coefficient, *Pasco County(FL), *Dade City area(FL), *Floridan aquifer.

The Dade City area, northeast Pasco County, Florida, is an area of about 260 square miles. Of the approximately 32 million gallons per day pumped from the Floridan aquifer in the area in 1975, about 16 million gallons per day were pumped from an area of about 0.25 square miles by a citrus processing plant. There are essentially two producing zones in the Floridan aquifer in the Dade City area. The upper zone is from about 10 feet above to about 150 feet below National Geodetic Vertical Datum of 1929, and the lower zone from about 300 to about 500 feet below NGVD of 1929. There is evidence of hydraulic interconnection of the upper and lower zones of the Floridan aquifer. This appears to be highly significant in terms of the geohydrology of the Floridan aquifer in the area, particularly with regard to its ground-water flow pattern, water quality, and aquifer hydraulic characteristics. In the immediate vicinity of the citrus processing plant, aquifer transmissivity may range from 200,000 to as much as 400,000 feet squared per day. It is probable the Floridan is only semiconfined in the immediate vicinity of the citrus processing plant. High aquifer transmissivity in the area is the reason why there are only a few feet of drawdown of the Floridan's potentiometric level even near the center of the well field. (USGS)
W81-00661

4C. Effects On Water Of Man's Non-Water Activities

LEAST COST DESIGN OF URBAN DRAINAGE SYSTEMS,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
J. Han, P. R. Rao, and M. H. Houck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131104, Price codes: A07 in paper copy, A01 in microfiche. Technical Report No 138, September 1980. 119 p, 24 Fig, 14 Tab, 39 Ref, 2 Append. OWRT A-056-IND(2).

Descriptors: *Urban drainage, Least cost, *Design criteria, *Drainage systems, Detention reservoirs, *Model studies, Hydrologic model, Urban runoff, Storm runoff, Urban hydrology, Storm drains, Storage capacity, Rainfall-runoff relationships, *Cost analysis.

An urban hydrologic model is developed which will give a least cost design for an urban drainage system. Unlike many of such models, the model reported provides for inflow rates estimated by the use of an adequate performing hydrologic model. A simple, readily usable, and theoretically sound model which includes ILLUDAS and a dynamic programming subroutine has been developed. The model is tested by using data from Upper Ross-Ade and Bar Berry Heights watersheds in West Lafayette, Indiana. The model was used to investigate the variation of systems costs with the variation in design parameters and to optimally size the detention storage volume for the least cost of the system. The least cost drainage design model developed in this study is easy to apply, practical to use, and considerable amounts of information may be easily obtained from the model. The model is helpful to engineers in the design of least cost drainage systems and in the choice of design parameters which are traditionally selected by using engineering judgement. (Wiersma-Ind)
W81-00552

OPTIMAL PARAMETER ESTIMATION AND INVESTIGATION OF OBJECTIVE FUNCTIONS OF URBAN RUNOFF MODELS,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
J. Han, and A. R. Rao.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131096, Price codes: A08 in paper copy, A01 in microfiche. Technical Report No. 135, September 1980. 153 p, 25 Fig, 54 Tab, 75 Ref. OWRT A-056-IND(1).

Descriptors: *Urban hydrology, *Urban runoff, *Rainfall-runoff relationships, *Model studies, Hydrologic models, Linear programming, Optimization, Least squares method.

This report deals with improvements of urban hydrologic models. Two areas are considered, namely; the optimal estimation of parameters, and the selection of an objective function to produce the best results. Three urban runoff models, ILLUDAS, SWMM and MINNOUR were studied and results showed that the optimal parameter estimates gave better regeneration and prediction performances than cases where the parameters were arbitrarily specified. Another result was that the complexity of the model structure did not guarantee better performance. Two sets of the objective functions were tested by using the data from the Upper Ross-Ade (West Lafayette, Ind.) and the Oakdale Avenue (Chicago) watersheds. The sum of the squared deviations between the observed and the calculated hydrograph ordinates has been the most frequently used objective function in the past and the results of the present study show that this gives the best overall performance. (Wiersma-Ind)
W81-00553

URBAN RUNOFF POLLUTION AND WATER QUALITY PLANNING,
Rutgers- The State Univ., New Brunswick, NJ. Water Resources Research Inst.
For primary bibliographic entry see Field 5B.
W81-00705

4D. Watershed Protection

EFFECTS OF BANK STABILIZATION ON THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF STREAMS AND SMALL RIVERS: AN ANNOTATED BIBLIOGRAPHY,
Missouri Univ., Kansas City. Dept. of Biology.
D. H. Stern, and M. S. Stern.
Fish and Wildlife Service, Biological Services Program, Report FWS/OBS-80/12, July 1980. 84 p, 213 Ref. 14-16-0009-78-035.

Descriptors: *Bibliographies, *Bank stabilization, *Water quality, Streams, Rivers, Water chemistry, Channels, Erosion, Ecology, Beds, Wildlife, Vegetation, Velocity, Stream improvement, Water temperature.

This annotated bibliography provides a reference source of information on the impacts of bank stabilization on the physical and chemical characteristics of streams and small rivers. The bibliography has 213 references, and is indexed by key subject headings, including the following: bed material, channel configuration, channelization impacts, coastal areas, construction, depth and stage, dissolved substances, ecology, erosion, fauna, flow variability, surface area, surveys, suspended solids, techniques, temperature, vegetation, and velocity. Many of the annotations provide a thorough summary of pertinent information contained in the respective references. (Moore - SRC)
W81-00557

EFFECTS OF BANK STABILIZATION ON THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF STREAMS AND SMALL RIVERS: A SYNTHESIS,
Missouri Univ., Kansas City. Dept. of Biology.
D. H. Stern, and M. S. Stern.
Available from Supt. of Documents, GPO, Washington, DC 20402. Fish and Wildlife Service, Bio-

logical Services Program, Report FWS/OBS-80/11, July 1980. 50 p, 109 Ref. 14-16-0009-78-035.

Descriptors: *Bank stabilization, *Water quality, Streams, Rivers, Water chemistry, Channels, Erosion, Ecology, Beds, Water temperature, Velocity, Stream improvement.

This report is a synthesis of available literature relating the effects of bank stabilization to the physical and chemical characteristics of streams. Depth and stage, water surface area of channel and floodplain, channel configuration, water current velocity, water temperature, suspended solids, bed materials, bedload, dissolvd substances, light transmissivity, and flow variability are discussed. Stream management should be confined to the shortest possible length of stream and employ the least amount of artificiality. (Moore - SRC)
W81-00559

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

BASE PEAK PROFILES OF GAS CHROMATOGRAPHY-MASS SPECTROMETRIC DATA OBTAINED FROM THERMAL DESORPTION OF ACTIVATED CARBONS,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
For primary bibliographic entry see Field 7B.
W81-00569

DETERMINATION OF CHEMICAL OXYGEN DEMAND USING AN OPEN-TUBE METHOD,
Yorkshire Water Authority, Leeds (England). Office of Scientific Services.
For primary bibliographic entry see Field 7B.
W81-00571

AUTOMATED DISTILLATION-SPECTOPHOTOMETRY PROCEDURE FOR DETERMINING AMMONIA IN WATER,
Ontario Ministry of the Environment, Rexdale, Water Quality Branch.
J. Crowther, and J. Evans.
Analyst, Vol 105, No 1254, p 841-848, September, 1980. 3 Fig, 3 Tab, 8 Ref.

Descriptors: *Ammonia, *Surface waters, *Spectrophotometry, *Automation, *Distillation, Nitrogen compounds, Industrial wastes, Separation techniques, Pollutant identification, Hydrogen ion concentration, Temperature, Waste water treatment, Analytical techniques, Color, Water pollution sources, Water analysis, Turbidity.

The automation of the distillation pretreatment procedure for the analysis of ammonia in waste water by spectrophotometry is described. A Technicon AutoAnalyzer was modified for the distillation of ammonia using either a phosphate (pH 7.4) or a borate (pH 9.5) buffer. Ammonia recovery depended on the pH of the distillation but was reproducible for both buffers. Both buffers allowed 95% recoveries of added ammonia from solutions of 55 test compounds. However, the system buffered to pH 9.4 was 1.4 times more sensitive than that buffered to pH 7.4. Less than 0.5% hydrolysis of 24 organic nitrogen contaminants occurred with both of the buffers. Formation of blockages in the distillation coils was encountered in the heating bath, but this was overcome by adjusting the temperature and flow rates to prevent formation of precipitates. The inefficiency of the partitioning of ammonia from the gas-liquid stream mixture into the re-sample stream was overcome by replacing the commercial distillation heads with a gas-liquid separator developed in-house. The effects of distillation temperature, hydrochloric acid concentrations, pH, and interfering pollutants on the system were also examined. Optimum temperature for the heat bath was found to be 112C for flow rates of 0.32-3.40 mL/min. Lead, some volatile organics (e.g., formaldehyde), and some organic nitrogen compounds interfered with the method. The technique was deemed suitable for the analysis of highly colored and/or turbid surface waters with possible application to grossly polluted industrial waste waters with added buffering. (Geiger-FRC)
W81-00576

BLANKING SYSTEM FOR THE SPECTROPHOTOMETRIC DETERMINATION OF AMMONIA IN SURFACE WATERS,
Ontario Ministry of the Environment, Rexdale. Water Quality Branch.
J. Crowther, and J. Evans.
Analyst, Vol 105, No 1254, p 849-854, September, 1980. 2 Fig, 6 Tab, 4 Ref.

Descriptors: *Spectrophotometry, *Ammonia, *Surface waters, *Automation, Analytical techniques, Nitrogen compounds, Laboratory tests, Colorimetry, Color reactions, Pollutant identification, Humic acids, Colbalt, Nitrates, Sulfides, Water analysis, Water Pollution sources.

A blanking system to be used in conjunction with automated spectrophotometry for the determination of low levels of ammonia in surface waters is described. A Technicon AutoAnalyzer was set up with dual flow cells for determinations of ammonia by a variation of the phenate-hypochlorite procedure and was used for analysis of ammonium chloride standards and suface water samples. The reference stream contained an equal flow of water in place of the nitroprusside catalyst that was used in the color-forming stream. The calibration was linear to within 0.001 mg/liter as nitrogen. The mean standard deviation for duplicate analyses of routine samples was 0.0023 mg/liter as nitrogen for ammonia levels < 0.080 mg/liter as nitrogen. Comparisons of results from blanking system analyses and an automated distillation spectrophotometric procedure gave correlations over 99.9%, with values being about 1% lower in the blanking technique. The blanking system experienced interference by high levels of cobalt (II, 2 mg/liter), nitrate (50 mg/liter as nitrogen), sulfide, and tannic and humic acids. These interferences should be taken into account before the blanking system is substituted for the distillation pretreatment step. (Geiger-FRC)
W81-00598

EXCHANGE OF COMMENTS ON SCHEME FOR CLASSIFICATION OF HEAVY METAL SPECIES IN NATURAL WATERS,
Colorado State Univ., Fort Collins. Dept. of Chemistry.
R. K. Skogerboe, S. A. Wilson, J. G. Osteryoung, T. M. Florence, and G. E. Batley.
Analytical Chemistry, Vol 52, No 12, p 1960-1963, October, 1980. 2 Tab, 23 Ref.

Descriptors: *Water analysis, *Heavy metals, *Thermodynamic behavior, *Speciation, Analytical techniques, Chemical analysis, Equilibrium, Chemical reactions, Mercury, Hydrogen ion concentration, Pollutant identification.

The trace metal speciation scheme for heavy metals in natural waters developed by Batley and Florence is discussed. The scheme is based on behavioral differences and identifies four classes of metals. It is suggested that the terms 'labile' and 'nonlabile' produce confusion, because the time lapse between sample treatment and analysis as well as the duration of the analysis itself may affect the ability to discriminate between labile and nonlabile metals. Thermodynamic or kinetic stability can also influence the results. The adjustment of pH can affect the degree of ionization and metal binding, causing a significant shift in relevant complexation equilibria. The addition of acetate can sharply shift metal-ligand equilibria even when the formation constants for the competing ligand systems are considerably higher than those of the metal-acetate systems. Addition of mercury can displace metals form their ligands. It is suggested that such equilibrium shifts and validation models be added to the scheme. In reply to the discussion, Florence and Batley emphasize that, in their scheme, results are operationally defined and do not necessarily reflect true equilibrium concentrations. It should not be assumed that the original equilibrium species concentrations will be obtained if mercury and acetate are omitted and pH is not altered. Florence and Batley are now developing a speciation scheme using a thiol complexing resin which is equilibrated with the sample at the original pH. (Titus-FRC)
W81-00599

ON-COLUMN CRYOGENIC TRAPPING OF SORBED ORGANICS FOR DETERMINATION BY CAPILLARY GAS CHROMATOGRAPHY,
Washington Univ., Seattle Dept. of Environmental Health.
For primary bibliographic entry see Field 7B.
W81-00600

DETERMINATION OF ALPHA-CHLOROACETANILIDES IN WATER BY GAS CHROMATOGRAPHY AND INFRARED SPECTROMETRY,
Monsanto Agricultural Products Co., St. Louis, MO. Research Dept.
For primary bibliographic entry see Field 7B.
W81-00601

INTERLABORATORY COMPARISON OF DETERMINATIONS OF TRACE LEVEL HYDROCARBONS IN MUSSELS,
National Bureau of Standards, Washington, DC. Organic Analytical Research Div.
S. A. Wise, S. N. Chesler, F. R. Guenther, H. S. Hertz, and L. R. Hilpert.
Analytical Chemistry, Vol 52, No 12, p 1828-1833, October, 1980. 1 Fig, 3 Tab, 16 Ref.

Descriptors: *Laboratory tests, *Bioindicators, *Water analysis, Water pollution, Fossil fuels, Gas chromatography, Variability, Oil pollution, Mussels, Monitoring, Analytical techniques, Laboratories, Organic compounds, Sampling.

The current use of mussels as a bioindicator of water pollution by fossil fuel hydrocarbons has necessitated the establishment of baseline data for comparison among laboratories dealing with the monitoring of marine environments by these organisms. Eight laboratories participated in analyses of hydrocarbons in two species of mussels collected from the waters of Simpson Bay, Alaska and from waters affected by natural oil seeps near Santa Barbara, California. Tissue homogenates of *Mytilus edulis and Mytilus californianus* were analyzed with no prescribed protocol by the laboratories so that results would reflect the variability of currently generated environmental measurements. Seven of the eight laboratories used column chromatography for the separation of trace hydrocarbons while one laboratory used liquid chromatography. All eight laboratories used gas chromatography for hydrocarbon analyses with various internal standards and methods for quantification and identification. Values for levels of total extractable hydrocarbons, total hydrocarbons in the gas chromatographic elution range and individual hydrocarbon compounds generally differed by less than a factor of four. Inhomogeneity of samples, analysis uncertainty and instability of sample storage over a period of nine months all contributed to an observed interlaboratory precision of plus or minus 40%. (Geiger-FRC)
W81-00602

GAS CHROMATOGRAPHIC-MASS SPECTROMETRIC ANALYSIS OF CHLORINATION EFFECTS ON COMMERCIAL COAL-TAR LEACHATE,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
For primary bibliographic entry see Field 7B.
W81-00603

INTRODUCTION (SPECIAL ISSUE ON THE PROGRESS OF AN ON-GOING PROGRAM TO IMPROVE METHODOLOGIES FOR THE ANALYSIS OF PRIORITY POLLUTANTS IN WASTE WATER EFFLUENTS),
Villanova Univ., PA.
For primary bibliographic entry see Field 7B.

W81-00609

ALUMINUM POLLUTION AND FISH TOXICITY,
Clyde River Purification Board, East Kilbride (Scotland).
For primary bibliographic entry see Field 5C.
W81-00619

THE ESTIMATION OF ARSENIC CONCENTRATIONS IN SEWAGE SLUDGES FROM THE LOTHIAN REGION,
Lothian Regional Council, Edinburgh (Scotland). Dept. of Drainage.
J. Webster.
Water Pollution Control, Vol 79, No 3, p 405-412, 1980. 4 Fig, 5 Tab, 10 Ref.

Descriptors: *Sewage sludge, *Chemical analysis, *Arsenic, *Atomic absorption spectrophotometry, Water pollution, Spectrophotometry, Analytical techniques, Industrial wastes, Domestic wastes, Sludge disposal, Sludge digestion, Pollutant identification.

The investigation of a sensitive, rapid, and inexpensive method for the determination of low concentrations of arsenic in sewage sludge is reported. This method uses sludge that has been digested using nitric/perchloric acid being pipetted into the reduction cell followed by the addition of borohydride. The liberated arsine is carried by a stream of nitrogen from the cell to a silica furnace, maintained at dull-red heat by the air-acetylene flame of an atomic absorption spectrophotometer. This procedure was not capable of great precision or accuracy; for sludge carried through the whole procedure the coefficient of variation was from about 50-90%. In view of these difficulties, a more accurate method is certainly required by water pollution laboratories for sludge samples, although this method would probably be suitable for river or sewage effluent samples. (McKeon-FRC)
W81-00621

AN AUTOMATED METHOD FOR THE SIMULTANEOUS DETERMINATION OF NITROGEN AND PHOSPHORUS IN PLANT MATERIAL, SLUDGE AND SOIL,
Water Research Centre, Stevenage (England).
For primary bibliographic entry see Field 7B.
W81-00622

GC/MS IDENTIFICATION OF TRACE ORGANICS IN PHILADELPHIA DRINKING WATERS DURING A 2-YEAR PERIOD,
Drexel Univ., Philadelphia, PA. Dept. of Chemistry.
I. H. Suffet, L. Brenner, and P. R. Cairo.
Water Research, Vol 14, No 7, p 853-867, July, 1980. 4 Fig, 4 Tab, 24 Ref.

Descriptors: *Potable water, *Organic compounds, *Gas chromatography, *Mass spectrometry, Impaired water quality, Separation techniques, Chemistry, Solvent extractions, Water analysis, Pollutant identification, Analytical technqiues, Industrial wastes, Aromatic compounds, Water quality.

This report describes gas chromatography with mass spectrometry (GC/MS) analyses of trace organic constituents found in Philadelphia drinking water from February 1975 to January 1977. Continuous on-line sampling techniques utilizing macroreticular resin and liquid-liquid extractor followed by GC/MS analyses isolated 138 organic compounds, 41 of which are on the EPA revised list of priority pollutants. Isolated compounds fell within five general classes: halogenated aromatic and halogenated aliphatic, other aromatics, other aliphatics, phthalate esters, and miscellaneous. Using computer reconstructed plots of GC profiles, the high variability of these compounds was evident by superimposing plots from successive weeks on top of one another. This high variability of organic compounds with time is indicative of a watershed with numerous industrial discharges. A comparison was made between the results presented in this report with others who have sampled Philadelphia drinking water during this two-year time period. (McKeon-FRC)
W81-00623

COMPARISON OF THE TOXICITY THRESHOLDS OF WATER POLLUTANTS TO BACTERIA, ALGAE, AND PROTOZOA IN THE CELL MULTIPLICATION INHIBITION TEST,
Bundesgesundheitsamt, Berlin (Germany, F.R.). Inst. fuer Wasser-, Boden-, und Lufthygiene.
G. Bringmann, and R. Kuhn.
Water Research, Vol 14, No 3, p 231-241, March, 1980. 10 Tab.

Descriptors: *Bioindicators, *Pollutant identification, *Aquatic algae, *Aquatic bacteria, *Protozoa, Toxicity, Environmental effects, Inorganic compounds, Aromatic compounds, Nitrogen compounds, Pseudomonas, Aquatic animals, Alcohols, Water pollution effects, Model studies, Chlorinated hydrocarbon pesticides, Monitoring, Pollutants, Scenedesmus, Self-purification, Aquatic microorganisms, Pesticides, Organic acids, Organic compounds.

In order for an organism to be used as a test organism in studies of water toxicology, its ecological and physiological requirements must be known. In addition, the model organism must provide early indications of potential water pollution that are easily detectable to the toxicologist. Analogous methods of the cell multiplication inhibition test were used to determine the toxicity threshold (TT) of 156 potential water pollutants for model organisms of biological self purification. Various inorganic compounds and organic chemicals including alcohols, aldehydes, ketones, organic acids and their salts, esters, aromatic hydrocarbons, organic nitro-compounds, and organochlorines were tested on a model bacterium, algae, and protozoa. Of the 156 inorganic and organic pollutants tested, 23 exhibited a pronounced selective toxicity to bacteria, Pseudomonas putida, 46 to algae, Scenedesmus quadricauda, and 43 to flagellate protozoa, Entosiphon sulcatum. It was concluded that determination of TT of potential water pollutants for three rather than one model organism from the microbiological spectrum would give a broader basis for assessing the environmental effects of water pollutants. (Geiger-FRC)
W81-00628

METHODS FOR DETECTION OF VIRUS IN WASTEWATER, APPLIED TO SAMPLES FROM SMALL SCALE TREATMENT SYSTEMS,
Royal Veterinary and Agriculture Coll., Copenhagen (Denmark). Dept. of Veterinary Virology and Immunology.
B. Lydholm, and A. L. Nielsen.
Water Research, Vol 14, No 2, p 169-173, February, 1980. 2 Tab, 15 Ref.

Descriptors: *Waste water treatment, *Viruses, *Pollutant identification, Domestic wastes, Sewage, Disinfection, Chemical precipitation, Heat treatment, Sewage treatment.

The effect of two small scale wastewater treatment systems on indigenous viruses in effluent from an emscher tank system serving a school in Denmark was examined. The emscher tank treatd a mixture of outlets from toilet, bath and kitchen. Viruses were consistently found from all three sources. At a pasteurization plant where outlets from toilets were treated by formaldehyde and heating to 76C for 30 minutes, a few samples from the influent were positive but no viruses were detected in the effluent. Four different methods of detecting viruses in wastewater were compared. Alum precipitation and acidic precipitation gave various degrees of virus detection depending on the amount of precipitate. With a two-phase separation technique, the lowest detectable virus concentration was 0.05 TCID50/ml of wastewater. When direct inoculation was used, none of the samples tested suggested the presence of viruses in blind passages. No differences were found in the efficiency of viral detection between the precipitation of two-phase concentration methods. The wastewater treatment operations of the pasteurization plant examined in this study seemed adequate for control of harmful viruses. (Geiger-FRC)
W81-00631

VARIABLE SOURCES OF SUSPENDED SEDIMENT AND NUTRIENTS FROM SMALL WATERSHEDS,
Max C. Fleischmann Coll. of Agriculture, Reno, NV.
M. H. Lohrey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-132425, Price codes: A04 in paper copy, A01 in michrofiche. Water Resources Center, University of Nevada, Publication No 43006, 1977. 62 p, 3 Fig, 1 Tab, 29 Ref, 4 Append. OWRT-A-072-NEV(1), 14-31-0001-6029.

Descriptors: *Sediment transport, *Sediment yield, *Nutrients, *Small watersheds, Watersheds(Basins), Chemical properties, Water quality, Streamflow, Channel morphology, Path of pollutants, *Nevada.

A stream channel classification procedure was developed to delineate and characterize the channel networks of watersheds in terms of factors affecting production of fluvial sediment and nutrients. The procedure was applied to 10 small watersheds in the east-central Sierra Nevada where yield of suspended sediment and nutrients (notably nitrate nitrogen, organic nitrogen, and orthophosphate) had been measured during the snowmelt period. The relationship and significance of these channel characteristics to the yield of the above parameters was tested with multiple regression techniques. Although the classification procedure was shown to be significant, length of ephemeral channels and flow proved to be the most important variables to the production of suspended sediment and nitrate nitrogen. However, channel characteristics did not prove to have a significant effect on production of organic nitrogen and orthophosphate. Predictive equations were developed for suspended sediment and nitrate nitrogen, but because of the limited number of observations (10), more research is necessary before the equations can be successfully utilized by the land.
W81-00638

WATER QUALITY OF TAMPA BAY, FLORIDA: JUNE 1972 - MAY 1976,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. L. Goetz, and C. R. Goodwin.
Geological Survey Water-Resources Investigations 80-12, 1980. 49 p, 36 Fig, 4 Tab, 24 Ref.

Descriptors: *Water quality, *Bays, *Florida, *Chemical properties, Nutrients, Metals, Physical properties, Sampling, Sites, Data collections, *Tampa Bay(FL).

A comprehensive assessment of the water quality of Tampa Bay, Florida, was initiated in 1970 to provide background information to evaluate the effects of widening and deepening the ship channel to the port of Tampa. This report provides results of water-quality sampling in the bay from 1972 to 1976, prior to dredging. Measurements of temperature, dissolved oxygen, pH, turbidity, specific conductance, biochemical oxygen demand, and total organic carbon were made as well as measurements for several nutrient, metal, and pesticide parameters. Many parameters were measured at as many as three points in the vertical. These data indicate that Tampa Bay is well-mixed vertically with little density stratification. Time histories of average temperature, dissolved oxygen, pH, turbidity, specific conductance and nutrient values within four subareas of Tampa Bay are given to reveal seasonal or other trends during the period of record. Temperature, dissolved oxygen, pH, turbidity, specific conductance, nutrient, biochemical oxygen demand, total organic carbon, and metal data are also presented as areal distributions. Nutrient concentrations were generally higher in Hillsborough Bay than in other sub-areas of Tampa Bay. Biochemical oxygen demand, total organic carbon, and total organic nitrogen distribution patterns show regions of highest concentrations to be

along bay shorelines near population centers. Of the metals analyzed, all were present in concentrations of less than 1 milligram per liter. (USGS)
W81-00662

CONDENSED REPORT ON THE USE OF ENZYMATIC CYCLING FOR HIGH SPECIFICITY AND PRECISION IN THE COLORIMETRIC ANALYSIS OF AMMONIA,
American Univ., Washington, DC. Dept. of Chemistry.
F. W. Carson, and H. W. Davies.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-137937, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, University of the District of Columbia, Washington, DC. Final Report, October 1980. 30 p, 2 Fig, 44 Ref. OWRT-B-009-DC(2), 14-34-0001-807.

Descriptors: *Ammonia, *Ammonium compounds, *Enzymes, *Analytical techniques, *Assay, Chemical analysis, Testing procedures, Nitrogen compounds, Organic compounds, Catalysts, Biochemistry, Colorimetry, Spectrophotometry, Instrumentation, Laboratory test, Nutrients, Inorganic compounds, Nutrient removal, Measurement, Water measurement, Evaluation, Testing, Water pollution.

A new method is reported for the colorimetric determination of ammonia in water, based on enzymatic cycling using the ammonia-specific glutamate dehydrogenase reaction followed by an enzymatic cycling reaction that provided controlled amplification of the response to ammonium ion. The cycling reaction product (a tetrazolium formazan) had a conveniently-measured visible absorption maximum at 600 nm. With the established procedure, absorbance versus original ammonium ion concentration plots were linear (correlation coefficients: 0.997-0.9998). The new method was simple and precise in the range of 0.0001-0.00001 molar ammonia concentrations. The sensitivity could be extended well below the ten nanomole per sample determination limit of the assay procedure described, using suitable modifications of the procedure. The coefficient of variation was 2% for a series of replicate measurements on samples containing 0.0000441 molar ammonium ion. A calibration curve for the determination of unknown concentrations could be constructed by carrying standard solutions through the procedure. The method only required the use of volumetric equipment and a spectrophotometer or colorimeter. Analysis time per sample was three hours, and all solutions could be prepared in advance and used for at least two weeks. (Zielinski-IPA)
W81-00698

EUTROPHICATION IN PEEL INLET-I. THE PROBLEM-DEFINING BEHAVIOR AND A MATHEMATICAL MODEL FOR THE PHOSPHORUS SCENARIO,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
G. M. Hornberger, and R. C. Spear.
Water Research, Vol 14, No 1, p 29-42, January, 1980. 6 Fig, 1 Tab, 51 Ref.

Descriptors: *Eutrophication, *Model studies, *Phosphorus, *Inlets, *Cladophora, Nutrients, Connate water, Nitrogen, Theoretical analysis, Simulation analysis, Monte Carlo method, Nuisance algae, Phytoplankton, Sediments, Photosynthesis, Biomass, Australia, Mathematical models, Computer models, Statistical methods, Peel Inlet.

To attack the problems of excessive algal growth in Peel Inlet, Western Australia, a simulated model assuming phosphorus to be the causitive element was examined. The alga in question was Cladophora aff. battersii. The factors which in reality have caused excessive algal growth are still uncertain, but it was hoped that a simulation model specifying a priori statistical distributions based on data from other euthrophied water systems would provide information or suggest new hypotheses during experimentation. A Monte Carlo approach was used for the model, which consisted of four compartments: Cladophora, phytoplankton, soluble phosphorus in the water column, and sediment (layer of decomposing material underlying much of the photosynthesizing Cladophora mat). Parameters considered included temperature-light growth coefficient, loss rate, and half-saturation content for Cladophora and phytoplankton, Cladophora maximum photosynthesis biomass, sediment-water diffusion and maximum sediment concentration, Cladophora and phytoplankton loss to sediment, groundwater concentration, tidal exchange efficiency parameter, and river sediment-phosphorus coefficient. A total of 626 simulation tests were done using the phosphorus scenario, and results indicate that this approach was amenable to the study of eutrophication by algae at the inlet. The feasibility of applying a nitrogen scenario to this particular problem is still being investigated. (Geiger-FRC)
W81-00725

THE USE OF HYDROBIA JENKINSI TO DETECT INTERMITTENT TOXIC DISCHARGES TO A RIVER,
Plymouth Polytechnic (England). Dept. of Environmental Sciences.
L. Brown.
Water Research, Vol 14, No 8, p 941-947, August, 1980. 1 Fig, 5 Tab, 15 Ref.

Descriptors: *Bioassay, *Dieldrin, *Heavy metals, *Gastropods, *Bioindicators, Chlorinated hydrocarbon pesticides, Chromium, Copper, Rivers, Toxicity, On-site tests, Laboratory tests, Water pollution sources, Industrial wastes, Textiles, River Holme, *England.

River pollution in the Holme, Yorkshire, England and its tributaries was monitored from October 1975 to October 1977 using an in situ bioassay with the operculate gastropod Hydrobia jenkinsi. Effluents containing toxic textile axcillary chemicals such as pesticides like dieldrin and heavy metals (copper and trivalent and hexavalent chromium) are discharged into the Holme. River samples artificially spiked with dieldrin or heavy metals were used in laboratory tests to assess survival rates of the gastropod to known levels of toxins. Close correlations were noted between laboratory toxicity test responses and those found when H. jenkinsi was exposed to polluted river water samples. When caged H. jenkinsi were exposed in situ to water from pollutant discharge sites along the waterways, gastropod responses made it possible to detect when discharges were contaminated with certain heavy metals, especially copper and hexavalent chromium. In situ death was not due solely to dieldrin or heavy metals. At levels in excess of 30,000 nanograms/liter, dieldrin failed to produce a toxic response in H. jenkinsi, suggesting the need for an organism susceptible to pesticides as an indicator for river pollution by this organochlorine compound. (Geiger-FRC)
W81-00745

SENSORY PROPERTIES AND ANALYSIS OF TWO MUDDY ODOUR COMPOUNDS, GEOSMIN AND 2-METHYLISOBORNEOL, IN WATER AND FISH,
Helsinki Univ. (Finland). Dept. of Limnology.
P. Persson.
Water Research, Vol 14, No 8, p 1113-1118, August, 1980. 4 Fig, 2 Tab, 49 Ref.

Descriptors: *Water quality, *Fish, *Odor, *Actinomycetes, Soil microorganisms, Organoleptic properties, Impaired water quality, Cyanophyta, Potable water, Rainbow trout, Pikes.

The sensory properties of geosmin and 2-methylisoborneol (MIB) in water and in the flesh of four species of fish were studied. Threshold odor concentrations indicate that both compounds have strong odor characteristics. Sensory panels were able to discriminate between geosmin and MIB down to 0.05 ppb. The sensitivity of the human nose still exceeds the sensitivity of chemical methods used for the analysis of these muddy odor compounds. The perceived intensities of geosmin and MIB by the sensory panels were proportional to the logarithm of the concentration of muddy odor compounds in the concentration ranges tested (for geosmin, up to 100 ppb, and for MIB, up to 10 ppb). The quantification of muddy odor compounds in water and fish by sensory methods may be possible, according to the results presented. (McKeon-FRC)
W81-00748

THE STABILITY OF BOVINE PARVOVIRUS AND ITS POSSIBLE USE AS AN INDICATOR FOR THE PERSISTENCE OF ENTERIC VIRUSES,
Royal Veterinary and Agriculture Coll., Copenhagen (Denmark). Dept. of Veterinary Virology and Immunology.
R. N. Srivastava, and E. Lund.
Water Research, Vol 14, No 8, p 1017-1021, August, 1980. 3 Tab, 14 Ref.

Descriptors: *Viruses, *Farm wastes, *Waste disposal, *Cultures, Public health, Human diseases, Wastes, Microbiology, Organic wastes, Domestic animals.

The suitability of the bovine parvovirus 1 (Haden virus) for use as an indicator of bovine enteric viruses was studied; the rates of its inactivation in liquid manure are reported. Calf kidney cell cultures, 0-24 hr old, were suitable for parvovirus studies and demonstrated a pronounced cytopathic effect. The virus' rate of inactivation (time in min for a 1 log unit reduction in titer) at 60, 70, and 80C was 360, 72, and 16 min. When the virus was seeded in liquid manure it became inactivated at a rate of around 6-8 days for 1 log unit under aerobic conditions at 5-20C. Inactivation under anaerobic conditions was highly temperature dependent: at 5C it took 188 days to decrease the titer 1 log unit, but at 20C it took only 20 days to reduce the titer 1 log unit. It is suggested that these parvoviruses may also be useful as indicators for human enteric viruses, e.g., infectious hepatitis virus. (McKeon-FRC)
W81-00749

5B. Sources Of Pollution

REMOVAL OF TRACE METALS FROM SEDIMENTS UNDER CHEMICO-OSMOTIC GRADIENTS,
Rhode Island Univ., Kingston.
V. A. Nacci.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127409, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, 1980, 33 p, 9 Fig, 2 Tab, 14 Ref. OWRT-A-070-RI(1), 14-0001-34-0142.

Descriptors: *Trace metals, *Sediments, *Self purification, *Ion transport, *Diffusion, Soils, Clay minerals, Water pollution, Geophysics, Heavy metals, Chemical reactions, Pore water, Porosity, Flow.

The investigation of the process in which a sediment will depollute itself under a chemico-osmotic gradient is presented in regards to both a theoretical and experimental approach. A system was designed utilizing electrical conductivity methods to determine the time rate of the diffusional process. This was in turn compared to theory based on irreversible thermodynamics and Terzaghi's theory on consolidation. The diffusivity measured through means outlined in this study was then shown to be reflective of the sediment properties. Once the diffusivity had been measured it was possible to obtain a 'time estimate' for depolluting these sediments.
W81-00504

CHLORINATED PARAFFINS AND THE ENVIRONMENT. 1. ENVIRONMENTAL OCCURRENCE,
Imperial Chemical Industries Ltd., Runcorn (England). Mond Div.
I. Campbell, and G. McConnell.
Environmental Science and Technology, Vol 14, No 10, p 1209-1214, October, 1980. 3 Fig, 6 Tab, 4 Ref.

Descriptors: *Pollutants, *Chlorinated paraffins, *Water pollution, Sediments, Aquatic life, Pikes, Mussels, Water birds, Food chains, Fish, Benthos, Path of pollutants, Water quality, Bird eggs, Foods.

The aim of this study was to measure the distribution and persistence of chlorinated paraffins (CP) in the environment, to determine their pathways through the environment, and to measure their concentrations in animal and vegetable life. Because CP are involatile, their transport by moving water is probably the only large-scale dispersion mechanism available to the product. However, half the waters studied (industrialized waterways and marine and fresh water remote from industry) showed C10-20 CP at 0.5-4 0 ppb, and less than half showed C20-30 CP at 0.5-2.0 ppb. CPs were seen in only a few sediments, at up to 0.5 ppm. C20-30 CP was almost absent from aquatic organisms, and C10-20 CP was present only at low levels. The median concentration distribution in seabirds' eggs was 0.2 ppm of C10-20 CP; C20-30 CP was almost absent. Mean CP levels in dairy/oil foods were higher (0.15-0.3 ppm) than in fruit/vegetables and beverages (0-0.025 ppm). Low levels of CP were detected in at least one human tissue from every subject tested. The total body burden of CP was estimated to be in the range 0-7 mg with an average of 2.3 mg. This quantity is not expected to pose a health hazard to man. There was no indication of biomagnification in any food chain, aquatic or on land, including the human food chain. (See also W81-00578) (McKeon-FRC)
W81-00577

INTERLABORATORY COMPARISON OF DETERMINATIONS OF TRACE LEVEL HYDROCARBONS IN MUSSELS,
National Bureau of Standards, Washington, DC. Organic Analytical Research Div.
For primary bibliographic entry see Field 5A.
W81-00602

243,244-CM IN COLUMBIA RIVER SEDIMENTS,
Oregon State Univ., Newport. Marine Science Center.
T. M. Beasley, and L. A. Ball.
Nature (London), Vol 287, No 5783, p 624-625, 16 October, 1980. 1 Tab, 8 Ref.

Descriptors: *Reservoirs, *Nuclear wastes, *Cores, *Columbia River, Lichens, Sediments, Water pollution sources, Movement, Mass spectrometry, Radioactive wastes, Sampling, Soil erosion, Radioisotopes, Fallout, Deposition(Sediments), Sediment transport.

Data derived from a sediment core sample taken from McNary reservoir in Washington State in August 1977 have shown the presence of 244-Cm in lichens as a result of the testing of nuclear devices. McNary reservoir lies about 100 km downstream from the Hanford Reservation in Washington State and contains accumulations of sedimentary materials transported by the Columbia River. Samples taken from the reservoir prior to 1961 were not analyzed for curium isotope production which could have occurred during nuclear testing from 1952 to 1958. Analyses for 239,240-Pu and 241-Am in Columbia River sediments demonstratd that activity resulting from testing was 1 to 3% that of 239,240-Pu. Mass spectrometry results have indicated that 25% of the 239,240-Pu radioactivity in McNary reservoir was derived from plutonium reactors on the Hanford Reservation. However, it was concluded that the 243,244-Cm found in this study was derived entirely from fallout. It was suggested that erosion processes on the land have mobilized and concentrated material containing radioactive curium in the river where they were subsequently sedimented. (Geiger-FRC)
W81-00611

PERSISTENCE OF 12 INSECTICIDES IN WATER,
Malaysian Agricultural Research and Development Inst., Selangor.
M. S. Sharom, J. R. W. Miles, C. R. Harris, and F. L. McEwen.
Water Research, Vol 14, No 8, p 1089-1093, August, 1980. 4 Fig, 1 Tab, 24 Ref.

Descriptors: *Persistence, *Microbial degradation, *Insecticides, *Pesticide kinetics, Path of pollutants, Aquatic microorganisms, Chlorinated hydrocarbon pesticides, Organophosphorus pesticides, Carbamate pesticides, Natural streams, Biodegradation, Water pollution sources, Pesticides, DDT, Dieldrin, Diazinon, Chemical degradation.

The persistence of 12 insecticides representing organochlorine, organophosphorus, and carbamate compounds was measured in distilled and natural water to evaluate the role of microbial degradation of insecticides in the aquatic environment. Four types of water were used: natural, distilled, sterlized natural, and sterilized distilled. Concentrations of insecticides used were 5 ppm for carbaryl, carbofuran, chlorphrifos, diazinon, ethion, leptophos, and parathion, 10 ppm for mevinphos, and 0.1 ppm for DDT. Rapid disappearance was observed for DDT, lindane, and parathion in natural water, but these same compounds were persisten in the other liquids, indicating the importance of microorganisms in their degradation. Little evidence of chemical decomposition of organochlorine insecticides was observed. Dieldrin, endrin, ethion and leptophos were the most stable compounds in water. In general, the other organophosphorus compounds and the carbamate insecticides were degraded in all four aqueous test systems, indicating the importance of chemical factors in their decomposition. Biological processes played a secondary role in the degradation of chlorphyrifos, diazinon, and carbaryl. After 8 wk in natural waters, dieldrin was the most persistent and parathion the least peristent of all the compounds tested. No evidence was found of persistnce based on chemical structure of the insecticides. (Geiger-FRC)
W81-00625

RVRFLO: A HYDRAULIC SIMULATOR OF WATER QUALITY IN THE HOUSATONIC RIVER IN CONNECTICUT,
Connecticut Agricultural Experiment Station, New Haven.
D. E. Aylor, and C. R. Frink.
Bulletin 780, April 1980. 53 p, 30 Fig, 8 Tab, 48 Ref, 2 Append.

Descriptors: *Connecticut, *Water quality, *River flow, Rivers, *Hydraulic similitude, *Simulaltion analysis, Phosphorus, Chlorine, Polychorinated biphenyls, Nitrogen, Impoundments, Water pollution control, Water pollution sources, Advection, Computer models, *Housatonic River(CT).

The Housatonic River has long received pollutants from municipal and industrial discharges, as well as runoff from forests and fields. The author's goal was to develop a computer simulation model to predict seasonal losses or gains of nutrients or other pollutants in the river. The results suggest strategies for controlling some of the pollutants, such as scaling down tertiary treatment operations, reducing water quality monitoring stations for more efficiency, and limiting phosphorus inputs during certain seasons. The model appears to provide reliable predictions of conservative elements, such as chlorine, and to provide a means of calculating the attenuation of non-conservative elements such as phosphorus and nitrogen. The model, called RVRFLO, is based on the physical principles of hydraulics and uses measurements of water velocity, temperature, and solute concentration at selected sites on th river as well as weekly mean flow and concentration data for major tributaries. The model accounts directly for three major processes governing the change in concentration of conservative chemicals in rivers: (1) advection or horizontal transport; (2) addition of chemicals by tributaries; and (3) dispersion of chemicals. RVRFLO is written in Fortran. (Garrison-Omniplan)
W81-00651

ANALYSIS OF STREAM QUALITY IN THE YAMPA RIVER BASIN, COLORADO AND WYOMING,
Geological Survey, Lakewood, CO. Water Resources Div.
D. A. Wentz, and T. D. Steele.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-108904, Price codes: A08 in paper copy, A01 in microfiche. Geolgical Survey Water-Resources Investigations 80-8, April 1980. 161 p, 80 Fig, 17 Tab, 59 Ref.

Descriptors: *Water quality, *Streamflow, *Hydrologic data, *Statistical methods, *Water temperature, Regional analysis, Low flow, Water chemistry, Sampling, Sites, Chemical analysis, Trace elements, Bottom sediments, Distribution patterns, Data collections, Computer programs, Time series analysis, Colorado, Wyoming, *Yampa River basin(CO-WY), Harmonic analysis.

Historic data show no significant water-temperature changes since 1951 for the Little Snake or Yampa Rivers, the two major streams of the Yampa River basin in Colorado and Wyoming. Regional analyses indicate that harmonic-mean temperature is negatively correlated with altitude. No change in specific conductance since 1951 was noted for the Little Snake River; however, specific conductance in the Yampa River has increaed 14% since that time and is attributed to increased agricultural and municipal use of water. Site-specific relationships between major inorganic constituents and specific conductance for the Little Snake and Yampa Rivers were similar to regional relationships developed from both historic and recent (1975) data. These relationships provide a means for estimating concentrations of major inorganic constituents from specific conductance, which is easily measured. Trace-element and nutrient data collected from August 1975 through September 1976 at 92 sites in the Yampa River basin indicate that water-quality degradation occurred upstream from 3 sites. The degradation resulted from underground drainage from pyritic materials that probably are associated with coal at one site, discharge from powerplant cooling-tower blowdown water at a second site, and runoff from a small watershed containing a gas field at the third site. Ambient concentrations of dissolved and total iron and manganese frequently exceeded proposed Colorado water-quality standards. The concentrations of many dissolved and total trace elements and nutrients were greatest during March 1976. These were associated with larger suspended-sediment concentrations and smaller pH values than at other times of the year. (USGS)
W81-00660

DISSOLVED-SOLIDS CONCENTRATIONS AND LOADS IN RETURN FLOWS TO THE COLORADO RIVER FROM AGRICULTURAL LAND IN SOUTHERN CALIFORNIA,
Geological Survey, Tacoma, WA. Water Resources Div.
J. M. Klein, and W. L. Bradford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-105652, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 80-52, July, 1980. 54 p, 11 Fig, 3 Tab, 18 Ref.

Descriptors: *Dissolved solids, *Return flow, *Water quality, *Colorado River, *California, Hydrogeology, Salinity, Irrigation water, Chemical analysis, Specific conductivity, Data collections, *Palo Verde Valley(CA), *Fort Mojave area(CA), *Bard Valley(CA).

The dissolved-solids concentration in Colorado River water increases from less than 50 mg/L (milligrams per liter) at the rivers's origin to about 700 mg/L at the California border and to about 900 mg/L at the United States-Mexico boundary. Much of the latter increase is due to depletion by agricultural use and irrigation return water with salts leached from soils under cultivation. Forty sites in three agricultural areas--Fort Mojave, Bard Valley, and Palo Verde Valley--were sampled to describe the dissolved-solids concentrations in return flows. Emphasis was on Palo Verde Valley. In the Fort Mojave area, the dissolved-solids concentration of Colorado River water was about 700 mg/L, while the concentration in water at the tile-drain convergence averaged about 2,500 mg/L. In

the closed sump that presently receives all irrigation return, concentrations ranged from 812 to 1,760 mg/L. In Bard Valley, water diverted from the river had an annual mean dissolved-solids concentration of about 835 mg/L. During the study, concentrations in two main drains carrying irrigation return water ranged from 953 to 1,290 mg/L. Selected drains in Palo Verde Valley were sampled several times to determine dissolved solids loads from subareas within the valley. Loads determined in this study were compared with those of an earlier study. In agreement with the earlier study, loads were found to be largest from three subareas in the southern half of the valley and comparatively small from the four subareas in the northern half. Smaller loads were found in this study from all subareas, however. The differences are thought to be due to generally lower water discharge observed in drains during this study. (USGS)
W81-00664

WATER QUALITY ASPECTS OF COAL TRANSPORTATION BY SLURRY PIPELINE,
Arkansas Univ., Fayetteville. Dept. of Civil Engineering.
J. W. Moore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142127, Price codes: A15 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, University of Arkansas, Project Completion Report, August, 1980. 325 p, 326 Fig, 24 Tab, 8 Ref. OWRT-B-0505-ARK(1), 14-34-0001-6058.

Descriptors: *Coals, *Pipelines, *Water quality, Water use, *Hydraulic transportation, *Slurries, Hydraulic conduits, Hydraulic structures, Pipes, Transportation, Structures, Trace elements, Waste water(Pollution), Alkalinity, Biochemical oxygen demand, Chemical oxygen demand, Suspended solids, Sulfates, Sodium, Hardness(Water), Nitrates, Silica, Conductivity.

Twenty-four batch reactors were designed and constructed for operation in two 12-gang stirring units, equipped with nitrogen purging above the slurry for anaerobic studies (when desired). The research program was designed to: (1) identify and characterize water quality changes during movement of western coal by slurry pipeline; (2) determine feasibility for using impaired quality water (such as municipal/industrial effluents) as slurry medium; and (3) determine tratment measures for restoring water quality of the slurry waste water if needed. Water input quality was varied and four slurry loadings (30, 40, 50, and 60% solids) were used to determine effects of slurry solids concentrations on water quality. Water quality parameters measured included alkalinity, BOD, COD, trace elements, dissolved solids, nitrate, sulfate, pH, silica, specific conductance, and total hardness, dissolved solids, sulfate and sodium would result from slurry pipelining for the western coals studied, with lower concentrations of Al, Pb, Ti, chloride, and nitrate to be expected in slurry waste water. Concentrations of Cr, Cu, Fe, Mn, Hg, Zn and phosphate were not detected. Slurry water quality changes occurred as a function of coal and water sources used. (Zielinski-IPA)
W81-00673

IN-SITU EVALUATION OF THE FILTERING FUNCTION OF A PIEDMONT CREEK SWAMP,
Georgia State Univ., Atlanta. Dept. of Chemistry.
C. H. Wharton, and H. P. Hopkins, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142234, Price codes: A04 in paper copy, A01 in microfiche. Environmental Resources Center, Georgia Institute of Technology, Atlanta, Report ERC 02-80, April, 1980. 46 p, 20 Fig, 1 Tab, 13 Ref. OWRT-A-071-GA(1).

Descriptors: *Water quality, *Swamps. *Filtration, *Cycling nutrients, Water flow, Georgia, *Trace elements, Analytical techniques, Aquatic habitats, Wetlands, Wastes, Nutrients, Nutrient removal, Waste assimilative capacity, Research and Development, Metals, Iron, Magnesium, Manganese, Sodium, Zinc, Aluminum, Water pollution sources, Phosphorous, Phosphates, Nitrogen, Ammonia.

A small northern piedmont region swamp in Georgia was monitored for two years, starting in September, 1976, to determine whether swamps might serve as sinks for nutrients and trace metals. Total amounts of phosphorus (orthoposphate, hyrolyzable phosphate, and total phosphate), nitrates, ammonia, and several trace metals (Fe, Mg, Mn, Na, An, Al) flowing into and out of the Cornish Creek Swamp were monitored over the two-year period. The swamp had been formed when a portion of the channellized Cornish Creek was filled up with sand and debris. Since the entrance/exit for the swamp was well-defined, the total amount of water moving through thhe swamp could be established. This information, combined with chemical analysis, allowed calculation of the total amount of chemical nutrients and metal passing through the swamp over the two-year study. Phosphorous, nitrogen and trace metals levels indicated the swamp waters to be pristine. During the majority of study months, total phosphate had a small reduction, and nitrate increased, after the water flowed through the swamp. Large quantities of ammonia left the swamp during Spring. Abnormally high zinc levels reached the swamp from an unknown source, but the swamp effectively reduced the zinc level in the stream. (Zielinski-IPA)
W81-00677

URBAN RUNOFF POLLUTION AND WATER QUALITY PLANNING,
Rutgers- The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr.
Journal of the Technical Councils of the American Society of Civil Engineers, Vol 106, No TC1, Proceedings Paper 15632, p 101-115, August 1980. 7 Fig, 3 Tab, 14 Ref, 1 Append. OWRT A-046-NJ(5) A-048-NJ(8), 14-34-0001-8032, 14-34-0001-9032.

Descriptors: *Water quality, *Urban runoff, *Planning, *Sampling, Sediments, Bed load, Biochemical oxygen demand, Nutrients, Heavy metals, Oil, Storms, Storm runoff, Hydrographs, Flood control, Pollutants, Path of pollutants, Water pollution, Water pollution sources, Streams, Environmental engineering, Hydrology.

Areawide Water Quality Planning under Section 208 of PL 92-500 is supposed to integrate two approaches, first, effluent treatment requirements, and, two, the achieving of stated water quality criteria with control of nonpoint as well as of point sources of pollution. Urban runoff pollution is considered one of the nonpoint sources, although it flows largely through storm and combined sewers. Section 208 planning has been handicapped for lack of adequate data and technology applicable to the highly variable storm flows that characterize urban runoff. Urban runoff pollution includes sediment, BOD, nutrients, heavy metals, and petroleum, most of which occur in particulate form. It is harmful to fish life, but the agents mainly reponsible are usually not identified. Planning of remedial measures requires consideration of both steady state and variable flow modeling. Detention storage for combined purposes of flood control and water quality appears to have some possibilities. (Sims-ISWS)
W81-00705

EUTROPHICATION IN PEEL INLET-II. IDENTIFICATION OF CRITICAL UNCERTAINTIES VIA GENERALIZED SENSITIVITY ANALYSIS,
California Univ., Berkeley. Dept. of Biomedical and Environmental Health Sciences.
R. C. Spear, and G. M. Hornberger.
Water Research, Vol 14, No 1, p 43-49, January, 1980. 2 Fig, 1 Tab, 10 Ref.

Descriptors: *Eutrophication, *Model studies, *Inlets, *Phosphorus, *Cladophora, Nutrients, Connate water, Sediments, Sediment transport, Deposition, Future planning(Projected), Theoretical analysis, Nuisance algae, Phytoplankton, Mathematical studies, Simulation analysis, Australia.

In this follow-up study based on a phosphorus model of cultural eutrophication processes in Peel Inlet, Western Australia, a generalized sensitivity analysis is outlined. The purpose of the analysis was to identify critical uncertainties in the present knowledge of the Peel Inlet system to direct the planning of future research. Results suggested that the nuisance algae Cladophora aff. battersii had access to nutrients from interstitial water in the sediments of the Inlet and from riverborne sediment deposits. From these findings, a recommendation was made to quantify the river input of sediment-bound nutrients as the next area of research and to establish to what extent these nutrients occur in sediments where Cladophora are most prominent. It was also suggested that further in-depth studies be made on Cladophora physiology. (Geiger-FRC)
W81-00726

PSEUDOMONAS AERUGINOSA AND ESCHERICHIA COLI IN SEWAGE AND FRESH WATER,
Dundee Univ. (Scotland). Dept. of Civil Engineering.
D. W. F. Wheater, D. D. Mara, L. Jawad, and J. Oragui.
Water Research, Vol 14, No 7, p 713-721, July, 1980. 3 Fig, 6 Tab, 22 Ref.

Descriptors: *E. coli, *Pseudomonas, *Domestic wastes, *Natural streams, *Sewage, Enteric bacteria, Sewage bacteria, Sewage treatment, Hospitals, Path of pollutants, Water treatment, Water pollution, Water pollution treatment, Freshwater, Rivers, Water pollution sources.

The incidence of Pseudomonas aeruginosa was evaluated along with E. coli as an indicator of fecal pollution in sewage effluent from domestic and hospital sources. P. aeruginosa was consistently found in domestic and hospital sewage at levels usually less than 300,000/100 ml and 500,000/100 ml, respectively. E. coli/P. aeruginosa ratios were normally less than 25 for hospital sewage and over 500 for ordinary domestic sewage. Both bacteria were reduced in number by about 90% after passage of the domestic or hospital effluents through sewage treatment plants, so that after treatment, the E. coli/P. aeruginosa ratios resembled those in the corresponding raw sewage. Calculations of both bacteria were also made from Dighty freshwater stream water and from human and animal fecal specimens. In the freshwater stream samples, P. aeruginosa numbers reflected levels of domestic wastes. Counts of E. coli and P. aeruginosa over the length of the Dighty were similar, except in agricultural areas, where P. aeruginosa was not detected even when E. coli counts were high. These findings were in agreement with results from fecal analysis showing the presence of P. aeruginosa in human samples and the lack of significant numbers of this organism in animal fecal samples. (Geiger-FRC)
W81-00736

THE MUTAGENIC ACTIVITY IN A SECTION OF THE SHEEP RIVER, ALBERTA RECEIVING A CHLORINATED SEWAGE EFFLUENT,
Calgary Univ. (Alberta). Div. of Pathology.
R. L. Moore, L. L. Osborne, and R. W. Davies.
Water Research, Vol 14, No 7, p 917-920, July, 1980. 3 Fig, 3 Tab, 18 Ref.

Descriptors: *Chlorination, *Mutagens, *Invertebrates, *Sewage effluents, Toxicity, Rivers, Suspended solids, Volatility, Environmental effects, Sewage treatment, Municipal wastes, Benthic fauna.

Studies were conducted to determine if increased mutagenic activity in the water, suspended particulate matter, and benthic macroinvertebrate populations in the Sheep River of Alberta was the result of chlorinated sewage discharge from the Turner Valley municipal sewage treatment plant. Sewage at the facility undergoes secondary treatment followed by chlorination before discharge into the river water. A gas refinery also discharges into the river near the sewage plant. Samples taken from six stations along the river were analyzed for muta-

genicity by the Ames-Salmonella/mammalian microsome mutagenicity test. Total residual chlorine levels at the time of sampling were also determined. Low levels of mutagenic activity were found in water and benthic macroinvertebrate samples, especially from sites where the chlorinated effluents were discharged. Evidence was also found of bioconcentration of chlorine throughout the benthic macroinvertebrate food chain. Due to the extreme volatility of some of the chlorinated compounds, little or no mutagenic activity on the particulate matter would be expected, as was observed. (Geiger-FRC)
W81-00737

MERCURY CONCENTRATIONS IN FISH INHABITING TWO POLLUTED LAKES IN NORTHERN CANADA,
Alberta Environmental Centre, Vegreville.
J. W. Moore, and D. J. Sutherland.
Water Research, Vol 14, No 7, p 903-907, July, 1980. 1 Fig, 1 Tab, 18 Ref.

Descriptors: *Mercury, *Sediments, *Fish, Trout, Pikes, Industrial wastes, Pollutant identification, Water quality, Water pollution, *Lakes, *Canada.

During 1978 and 1977 concentrations of total mercury were determined in the sediments, water and fish of Giauque Lake and Thompson Lake in northern Canada. Mercury laden industrial discharges had previously been permitted to flow into the lakes. In Giauque Lake the trout contained an average of 3.68 mg/kg mercury in their muscle tissue, while average concentrations in northern pike and round whitefish were 1.75 and 1.22 mg/kg, respectively. Mercury levels greater than 500 micrograms/kg were found on about 7% of the lake bottom. In water, the mercury concentrations were below detectable limits, 0.2 microgram/liter. Mercury levels in Thompson Lake northern pike averaged 1.69 mg/kg; in whitefish the highest value was 0.6 mg/kg. Heavy concentrations of mercury in the sediments reached 1300 micrograms/kg. Almost 15% of the lake bottom contained mercury in excess of 500 microgram/kg. It was concluded that northern pike are still accumulating mercury from exposed tailings which were deposited in Thompson Lake about 30 yr ago. It was also concluded that the contamination of only a small part of a lake can result in high pollutant levels in fish throughout the entire lake. (Baker-FRC)
W81-00742

5C. Effects Of Pollution

CONCORDANCE OF HEAVY METAL AND ANTIBIOTIC RESISTANCE ON PLASMIDS OF CHESAPEAKE BAY BACTERIA,
Maryland Univ., College Park. Water Resources Research Center.
L. A. McNicol.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127532, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No 58, October 1980. 74 p, 7 Fig, 21 Tab, 70 Ref. OWRT-A-048-MD(1), 14-34-0001-9022.

Descriptors: Pollutants, *Water pollution effects, *Chesapeake Bay, *Antibiotics(Pesticides), *Aquatic bacteria, *Heavy metals, *Bioassay, Epidemiology, Toxicity, Water pollution, Bodies of water, Organic compounds, Bactericides, Bacteria, Microorganisms, Bioindicators, Metals, Water pollution sources, Chemical wastes, Lead, Nickel, Cadmium, Mercury, Pollutant identification.

Antibiotic-resistant and heavy metal-resident phenotypic frequency was measured in Chesapeake Bay bacterial strains obtained from Bay sites differing significantly in water quality. The phenotypes were estimated from dose-response curves using direct plating, replica plating, and minimal inhibitory concentration (MIC). Resistant and sensitive organisms could be distinguished by concentrations of twenty micrograms per milliliter for various antibiotics (amphicillin, chloramphenicol, nalidixic acid, penicillin, streptomycin, and tetracycline), and of 0.05 millimolar for the heavy metals tested (cadmium, mercury, nickel, and lead). Individual resistance phenotypes of 1816 isolates were determined with the replica technique, with 85% resistant to at least one antibiotic and a surprising 2% resistant to all six drugs tested. Occurrence of resistant organisms did not correlate with water quality, sampling location, season, sample type, or physical parameters of the site. Ninety-two percent of organisms examined were resistant to at least one metal studied, with 43% resistant to all metals, but resistance did not correlate with any station or sample parameters. Metal and drug resistant phenotypes did correlate positively with one another, but these two traits were not appreciably linked on plasmid DNA. (Zielinski-IPA)
W81-00508

ENVIRONMENTAL ASSESSMENT OF THE ALASKAN CONTINENTAL SHELF: KODIAK INTERIM SYNTHESIS REPORT -- 1980.
Science Applications, Inc., Boulder, CO.
National Oceanic and Atmospheric Administration Report, March 1980. 326 p, 167 Fig, 76 Tab, 565 Ref.

Descriptors: *Alaska, *Environmental effects, *Energy, *Natural gas, *Continental shelf, Leases, Exploitation, Arctic, Subarctic, Geographical regions, Pacific coast region, Regions, Cold regions, Legal aspects, Marine geology, Aquatic life, Water quality, Economic impact, Pollutants, Water pollution, Fisheries.

The Bureau of Land Management requested the National Oceanic and Atmospheric Administration to conduct the Outer Shelf Environmental Assessment Program (OCSEAP), covering several lease areas on the Alaskan Outer Continental Shelf (OCS) from the subarctic Northeast Gulf of Alaska to the arctic Beaufort Sea. Extensive environmental studies must be conducted before OCS area development can safely proceed on oil and gas deposits. The continental shelf east of the Kodiak Archipelago had been selected for exploration and development of such deposits (OCS Sale 46). If economic gas recovery is possible, petroleum development off Kodiak would include a liquified natural gas plant ashore and extensive gas plant transport lines from offshore wells. The Archipelago and adjacent shelf waters have high biological activity, endangered species, with the coastline highly vulnerable to oil spill damage. Probable ecological impacts were noted for such plant development. OCSEAP studies in Kodiak resulted in an extensive data base on marine environment biology, chemistry, geology, microbiology, physics, and in interdisciplinary workshops. Four major environmental issues were identified for the studies program: impact on commerical fisheries; geological hazards; contaminant transport; protection of regional biota and important habitants. The lease sale date was planned for December 1980. (Zielinski-IPA)
W81-00512

ANTHROPOGENIC INFLUENCE OF THE SEDIMENTARY REGIME OF AN URBAN ESTUARY - BOSTON HARBOR,
Woods Hole Oceanographic Insitution, MA. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2L.
W81-00519

IMPACTS OF URANIUM MINING AND MILLING UPON THE FISH AND WILDLIFE RESOURCES OF THE NEW MEXICO SAN JUAN BASIN REGION,
New Mexico State Univer., Las Cruces. Dept. of Fishery and Wildlife Sciences.
S. C. Meneely, S. L. Duzan, and S. D. Schemnitz.
Available from Supt. of Documents, GPO, Washington, DC 20402. Fish and Wildlife Service, Biological Services Program, Report FWS/OBS-80/56, September 1980. 171 p, 7 Fig, 20 Tab, 235 Ref, 6 Append. 14-16-0002-77-906.

Descriptors: *Mine wastes, *Radioactive wastes, *Uranium radioisotopes, *Wildlife, *Fish, Mills, Mine water, Vegetation, Indian reservations, New Mexico, Arizona, Colorado, Widllife habitats, Water pollution.

Fish and wildlife species and their habitats within the San Juan Basin of New Mexico, Arizona and Colorado on Indian lands are identified. Field inventories were taken on existing and proposed uranium development sites during the summer of 1979 to determine the distribution of wildlife species. The inventories indicate species migration and emigration associated with this type of mining activity. Potential impacts that may be realized if different stages of uranium mining and milling are conducted were identified, based on development projections from the Bureau of Indian Affairs. Some species benefited as a result of water impoundments, in the water discharge and fencing to restrict grazing activity from the site. Direct impacts of uranium mining and milling include habitat alteration, contamination of aquifers and contamination by radionnuclides and toxic elements from uranium mill ponds and trailing piles. (Moore-SRC)
W81-00555

RESPONSES OF SUBMERSED VASCULAR PLANT COMMUNITIES TO ENVIRONMENTAL CHANGE: SUMMARY,
East Carolina Univ., Greenville, NC. Dept. of Biology.
G. J. Davis, and M. M. Brinson.
Available from Supt. of Documents, GPO, Washington, DC 20402. Fish and Wildlife Service, Biological Services Program, Report FWS/OBS-80/42, August 1980. 19 p, 1 Tab, 7 Ref. 14-16-0009-78-032.

Descriptors: *Aquatic plants, *Turbidity, *Sedimentation, *Plant growth, Aquatic environment, Water levels, Waves(Water), Seasonal, Nutrients, Submerged plants, Rooted aquatic plants, Eutrophication, Light intensity.

Since many land and water development projects have the potential of altering the environment of aquatic vascular plants, it is essential to unsdertand how aquatic plant species respond to changing physical, chemical, and biological conditions. Factors that affect the growth of submersed, rooted, aquatic macrophytes are reviewed, including: light transmission, fluctuating water levels, wave action, sedimentation, nutrients, and seasonal effects. Groups of macrophyte species are listed according to resistance to ecosystem change, and examples of human activities which may adversely affect natural systems and the possible effects on submerged plant populations are given in a table. (Moore - SRC)
W81-00556

STRATEGY FOR ASSESSING IMPACTS OF POWER PLANTS ON FISH AND SHELLFISH POPULATIONS,
National Power Plant Team, Ann Arbor, MI.
For primary bibliographic entry see Field 6B.
W81-00563

POTENTIAL IMPACTS OF LOW PH ON FISH AND FISH POPULATIONS,
National Power Plant Team, Ann Arbor, MI.
E. S. Fritz.
Available from Supt. of Documents, GPO, Washington, DC 20402, Report FWS/OBS-80/40.2, October 1980. 17 p, 3 Tab, 45 Ref.

Descriptors: *Fish physiology, *Toxicity, *Acidity, Environmental effects, Fish populations, Fish reproduction, Fish diseases, Predation, Acidic waters, Habitats, Fish genetics.

One of the most alarming impacts associated with increasing acidification of surface waters, and acid precipitation is the decline and extinction of fish populations and assemblages in lakes and streams. The effects of low pH on fish are reviewed. The toxic effects of low pH are found to differ among species, populations, and age-groups of the same species. Field studies show that the toxicity of low pH is compounded by other water characteristics. Low pH could increase susceptibility to disease,

impair osmoregulation and ionregulation, inhibit hormone production or activity, result in genetic damage, change predator-prey relationships, degrade habitat, and increase the availability of toxic substances. Low pH can result in reproductive failure on the population level, recruitment failure, and on the individual level, cessation of spawning. Slight declines in productivity as they relate to stressed populations, have the potential to result in unrecoverable drops in population density. (Moore - SRC)
W81-00564

CHLORINATED PARAFFINS AND THE ENVIRONMENT. 2. AQUATIC AND AVIAN TOXICOLOGY,
Imperial Chemical Industries Ltd., Runcorn (England). Mond Div.
J. R. Madeley, and R. D. N. Birtley.
Environmental Science and Technology, Vol 14, No 10, 1215-1221, October, 1980. 1 Fig, 7 Tab, 15 Ref.

Descriptors: *Toxicity, *Chlorinated paraffins, *Path of pollutants, *Water pollution sources, Diets, Rainbow trout, Water birds, Mussels, Bioassay, Fish behavior, Biochemical oxygen demand, Anaerobic digestion, Microorganisms, Biodegradation, Pollutants, Fish.

The results of laboratory studies on toxicity, bioaccumulation, and biodegradation of chlorinated paraffins (CP) in the aquatic environment are presented; some information on avian and mammalian toxicity is also given. Short-term toxicity tests (96 hr) demonstrate the very low acute toxicity of CP to rainbow trout and bluegills. During more prolonged exposure, neurotoxic symptoms appeared when lower molecular weight compounds were tested. The level of CP in the body tissues of mussels was always less than that adsorbed on food particles filtered from the water. This uptake was reversed on substitution of 'clean' diets, and the CP appeared to be expelled from the animal in its original form. Rainbow trout appeared to metabolize CP. Up to 80% of assimilated C14 from C14-labeled CP in tissues was not recognizable as CP after 13 days. Microorganisms previously acclimated to specific forms of CP showed a greater ability to degrade the compounds than organisms normally treating domestic sewage. Increasing chlorination percentage inhibited biodegradation. Short-chain compounds were most readily oxidized at chlorine levels below 60%. Complete breakdown of long-chain CP was observed over a period of 8 Wk. Anaerobic microorganisms did not degrade a specific CP in 30 days. Cereclor S52 was of low subacute toxicity when fed to ring-necked pheasants and mallard ducks. In two predictive in vitro tests, three grades of CP showed no mutagenic potential. (See also W81-00577) (McKeon-FRC)
W81-00578

EFFECTS OF NUTRIENTS ON ALGAL GROWTH IN WATERS OF THE CANBERRA REGION AND RELATED CONTROL MEASURES,
Department of Housing and Construction, Phillip (Australia).
D. A. Henley, D. C. Keiller, and A. L. Downing.
Water Pollution Control, Vol 79, No 2, p 195-212, 1980. 12 Fig, 6 Tab, 21 Ref.

Descriptors: *Sewage treatment, *Water quality, *Algal control, *Nutrients, Nitrogen, Phosphorus, Mathematical models, Algae, Rivers, Waste water treatment, Water pollution, Water pollution control, Water resources planning, Sewage effluents, Lakes, Treatment facilities.

The effects of phosphorus and nitrogen in sewage effluent on algal growth in the rivers and lakes surrounding the Lower Molonglo Water Quality Control Centre, near Canberra, Australia were studied in order to guide operation of the plant. A river water quality model was developed that related water quality in rivers to their flow, to inputs of pollution from land and from sewage, and to the influences of 'self-purification' in the rivers. The model predicted that the removal of nitrogen and phosphorus at the plant would almost certainly produce a massive improvement in the quality of lake waters. Removal of nitrogen alone would probably bring about a similar, less marked, result. In neither case would the chance of major algal blooms be completely eliminated. Removal of phosphorus alone would be expected to bring about a major improvement in quality provided that all Canberra's sewage were treated, and the maximum phosphorus removal possible at the plant were consistently achieved. Removing phosphorus alone for as much time as possible would be of major economic benefit. At the time of writing, the plant had not brought denitrification tanks into use, and with limited phosphorus removal, little, if any, improvement in algal growth could be seen. This is not inconsistent with the conclusion that phosphorus removal to the full extent of plant capabilities will be required to achieve significant improvement. A discussion follows this article. (McKeon-FRC)
W81-00586

AGRICULTURAL AREA IMPACTS WITHIN A NATURAL AREA: CADES COVE, A CASE HISTORY,
Great Smoky Mountains National Park, Gatlinburg, TN. Uplands Field Research Lab.
S. P. Bratton, R. C. Mathews, and P. S. White.
Environmental Management, Vol 4, No 5, p 433-448, September, 1980. 11 Fig, 4 Tab, 33 Ref.

Descriptors: *Water pollution, *Nutrients, *Agricultural runoff, *Coliforms, Hay, Water temperature, Turbidity, Phosphorus compounds, Nitrogen, Ammonia, Water quality, Aquatic bacteria, National Parks, Tennessee, Pollutant identification, Benthic fauna, Fish, Vegetation, Wildlife.

Agricultrual management in Cades Cove, an historic district in Great Smoky Mountains National Park, has affected natural resources both within the district and in the adjoining natural areas. A program of hay and cattle production begun in 1967 brought about a number of changes in the terrestrial flora and fauna and in the aquatic systems. Changes in the aquatic system included siltation and an increase in nutrient loading. Water temperatures in the stressed area were increased as were turbidity and nutrient (PO4 and NO3) loads. The number of taxa represented in the benthos community in the stressed area of Cades Cove was also lower than in other stations monitored above and below the Cove. Coliform counts in the Cove were frequently in the 100s (per 100 ml) and occasionally in the 1,000. The fecal steptococcus to fecal coliform ratios indicated that animals rather than human sources were responsible. The fecal coliform levels were often higher than the State of Tennessee standards for primary contact (swimming: desirable level $<$ or $=$ 200) and were sometimes higher than secondary contact standards (desirable level $<$ or $=$ 1,000). The actions taken to date, including fencing cattle out of stream beds and reduction of herd size, has already had a restorative effect on the Cove. The effect of the agricultural management of Cades Cove on wildlife populations and vegetations is also discussed. (McKeon-FRC)
W81-00612

ALUMINUM POLLUTION AND FISH TOXICITY,
Clyde River Purification Board, East Kilbride (Scotland).
J. B. Hunter, S. L. Ross, and J. Tannahill.
Water Pollution Control, Vol 79, No 3, p 413-420, 1980. 3 Fig, 9 Tab, 9 Ref.

Descriptors: *Water pollution sources, *Fishkill, *Aluminum, Bioassay, Brown trout, Effluents, Pollutant identification, Sewage sludge, Hydrogen ion concentration, Waste Disposal, Toxins, Industrial wastes, Water treatment, Photosynthesis, Laboratory tests.

The chemistry, toxicity, and pathology of aluminum (Al) was studied in relation to stream pollution from an anodizing plant. Al was implicated in the sporadic occurrence of fish kills (brown trout) during 1974 and 1975 in the stretch of the Black Cart Water between Howwood and Kilbarchan, Scotland. The acute toxicity of Al was found to depend on the pH of the river water. In laboratory tests using tap water at neutral pH, Al was not acutely toxic even at concentrations of 200 mg/liter. However, at a concentration of 50 mg Al/liter, there was a 40% mortality in 96 hr at pH 8.0 and a 100% mortality in 42 hr at pH 8.5 and 9.0. In addition to the Al from the anodizing plant, a water treatment plant puts an additonal load of Al of up to 1.3 mg/liter on the stream to give a total of up to 3.7 mg/liter of Al downstream from the factories discharge point. It appears that the fish kills were due to the Al concentration in association with an increase in river pH, but whether this increase was caused by the anodizing effluent or photosyntheses is not certain. It is suggested that the maximum concentration of aluminum in the stretch of the river be limited to 0.5 mg/liter. (McKeon-FRC)
W81-00619

EFFECTS OF URBAN RUNOFF AND TREATED MUNICIPAL WASTEWATER ON A MANMADE CHANNEL IN NORTHEASTERN ILLINOIS,
Metropolitan Sanitary District of Greater Chicago, Roselle, IL.
I. Polls, C. Lue-Hing, D. R. Zenz, and S. J. Sedita.
Water Research, Vol. 14, No 3, p 207-215, March, 1980. 7 Fig, 6 Tab, 17 Ref.

Descriptors: *Water quality, *Benthic fauna, *Channels, *Sewage effluents, *Storm runoff, Bottom sampling, Chicago River, Water pollution sources, Sewage treatment, Isopods, Oligochaetes, Aquatic animals, Water pollution, Sewers, Diptera, Water analysis, Urban runoff, Municipal wastes.

Monthly samples were collected to monitor the composition of benthic macroinvertebrates and water quality at five sites along the North Shore Channel in Illinois from January to November of 1973. Entering the channel 5.4 km above its junction with the North Branch of the Chicago River are secondary treated effluents of the Northside Sewage Treatment Plant. During storms, sewer overflows add to the channel above and below the treatment plant discharge. Results were compared to a biological survey conducted by the U.S. Public Health Service in 1961. The most important change occuring in the benthic faunal composition downstream from the plant outfall was the presence in 1973 samples of large numbers of isopods and midges, suggesting improved water quality. The 1973 results also indicated that water quality was markedly affected by both urban runoff and a point source effluent from the Northside Sewage Treatment Plant. Compared to upstream values, levels of ammonium nitrogen, nitrite-nitrate nitrogen, total phosphorus, dissolved solids and conductivity in downstream channel waters were increased ($p < 0.05$). The benthic macroinvertebrate composition above and below the treatment plant outfall was characteristic of that found in organically enriched rivers. Samples from the five locations consisted of 89% pollution-tolerant oligochaetes, 7.4% chironomids, 3.5% isopods, and 0.1% leeches. Populations of macroinvertebrates were found to be elevated at all sample points below the treatment plant outfall compared to upstream populations. Macroinvertebrate numbers collected over the 11-month period averaged 9,360/sq m above the outfall and 128,550/sq m for areas 5.3 km below the outfall. (Geiger-FRC)
W81-00626

GROWTH RESPONSES OF SELECTED FRESHWATER ALGAE TO TRACE ELEMENTS AND SCRUBBER ASH SLURRY GENERATED BY COAL-FIRED POWER PLANTS,
Ames Lab., IA.
R. W. Vocke, K. L. Sears, J. J. O'Toole, and R. B. Wildman.
Water Research, Vol 14, No 2, p 141-150, February, 1980. 8 Tab, 67 Ref.

Descriptors: *Aquatic algae, *Toxicity, *Coal mine wastes, *Trace elements, Fly ash, Arsenic compounds, Mercury, Cadmium, Slurries, Scenedesmus, Laboratory tests, Water pollution control, Bioindicators, Environmental effects, Path of pollutants, Heavy metals, Growth rates.

The toxicity of trace elements arsenic (As), cadmium (Cd), mercury (Hg), and Selenium (Se) from coal-fired power plants and scrubber ash slurry extract (SASE) to the freshwater algae Ankistrodesmus falcatus, Scenedesmus obliquus, Selenastrum capricornutum, and Microlcoleus vaginatus were investigated in growth response laboratory tests. Algae were exposed to solutions of Na2HAsO4.7H2O, CdSO4, HgSO4, and Na2SeO4, and SASE from a western U.S. coal-fired power plant complex in a modified version of the EPA Algal Assay Procedure Bottle Test. Levels of trace pollutants in mg/liter in the growth response experiments ranged from 0.01-100.0 for As, 0.001-0.30 for Cd, 0.001-1.0 for Hg, and 0.01-50.0 for Se. SASE was tested at levels of 0.01-100%. A chemical analysis of SASE was made, and regression equations of algal responses to selected trace elements or SASE treatment levels were calculated. Median effective concentration values for the algae tested ranged from 0.048-30.761 mg/liter for As, 0.005-0.019 mg/liter for Cd, 0.33-0.253 mg/liter for Hg, 0.033-8.511 mg/liter for Se, and 3.048-15.417% for SASE. As was significantly inhibitory to the growth of Ankistrodesmus and Scenedesmus at 0.1 and 0.01 mg/liter, respectively, while Selenastrum growth was inhibited significanlty at 25 mg/liter As. Significant growth inhibition occurred in Selenastrum at 0.05 mg/liter Cd, and in the other three species at 0.01 mg/liter Cd. The first significant inhibition of growth of Ankistrodesmus, Scenedesmus, Selenastrum, and Microcoleus occurred at 0.05, 0.1, 0.01, and 0.4 mg/liter Hg, respectively and at 0.01, 0.1, 0.3 and 10 mg/liter Se, respectively. Significant growth inhibition to the four species in the above order was observed with exposure to 1, 5, 10 and 5% concentrations of SASE, respectively. (Geiger-FRC)
W81-00629

THE EFFECTS OF HARDNESS, ALKALINITY AND PH OF TEST WATER ON THE TOXICITY OF COPPER TO RAINBOW TROUT (SALMO GAIRDNERI),
Alberta Univ., Edmonton. Dept. of Zoology.
T. G. Miller, and W. C. Mackay.
Water Research, Vol 14, No 2, p 129-133, February, 1980. 2 Fig, 2 Tab, 34 Ref.

Descriptors: *Hydrogen ion concentration, *Copper, *Alkalinity, *Hardness(Water), *Rainbow trout, *Toxicity, Laboratory tests, Calcium compounds, Heavy metals, Lethal limits, Acidity, Chemical analysis, Spectrophotometry, Water quality, Water analysis, Potable water.

The relative effects of water hardness, alkalinity, and pH on the toxicity of copper to fingerling rainbow trout were investigated in laboratory tests. Fish were kept in test chambers under three separate combinations of alkalinity and hardness in experiments that took 9 months to complete. Variations in alkalinity were accomplished by changing the levels of bicarbonates in the initial dilution of the deionized water. The incipient lethal concentration of copper which caused 50% mortality (ILC50) was determined initially and at the end of the 9-month period. No difference was found in the ILC50 values measured before and after the experiment. Copper was found to be less potent in dechlorinated tapwater than in artificial freshwater ($p < 0.05$). The interaction of copper and acid was found to be antagonistic at pH values of 4.7 or less. A synergistic effect between acid and copper was observed at a pH of 5.4 which caused an ILC50 at copper levels equivalent to 22 micrograms/liter (47% of the control value at pH 7.2). Calcium hardness of the test water was more important than alkalinity in reducing the toxicity of copper. At a hardness of 12 mg/liter, increasing the alkalinity from 10 to 50 mg/liter had no effect on ILC50. When an alkalinity of 10 mg/liter was combined with an increase in hardness from 12 to 100 milligrams/liter, the ILC50 value was increased threefold. However, an antagonistic effect on copper toxicity was noted at a water hardness of 100 mg/liter when the alkalinity was increased. (Geiger-FRC)
W81-00633

PRELIMINARY OBSERVATIONS ON THE BENTHIC MACROINVERTEBRATE COMMUNITIES OF ROSS BAY, A POLLUTED AREA OF LOUGH LEANE, SOUTH-WEST IRELAND,
University Coll., Dublin (Ireland). Dept. of Zoology.
E. J. Wise, and A. O'Sullivan.
Water Research, Vol 14, No 1, p 1-13, January, 1980. 4 Fig, 4 Tab, 41 Ref.

Descriptors: *Lakes, *Benthos, *Water pollution, *Nutrients, *Sewage effluents, Phosphorus, Nitrogen, Ammonia, Chlorophyll, Algae, Biomass, Invertebrates, Biochemical oxygen demand, Dissolved oxygen, Suspended solids, Eutrophication, Detergents, Ireland, Ross Bay.

An attempt was made to quantify the effects of sewage effluent on the density distribution of benthic macroinvertebrates in the stony littoral zone of Ross Bay, Lough Leane, Ireland. The Lough is undergoing accelerated cultural eutrophication mainly due to the discharge of untreated human sewage and domestic detergents. Dissolved oxygen levels were satisfactory over the whole of Ross Bay with the exception of the station closest to the sewage outfall (Station 1), where oxygen depletion was observed (< 30% saturation). BOD levels were consistently low (range 0.8-4.7) except at Station 1 where a value of 5.8 was received. Nitrogen and phosphorus compounds showed a significant negative correlation with distance from the sewage outfall ($p < 0.05$). Chlorophyll a levels reached a peak at Stations 3-5 (mildly polluted) as a result of interaction between nutrient availability and the toxic effects of sewage loading. A relatively low total biomass (12.5 g/m) was found at Station 1 (septic/degradation zone), while organic enrichment promoted a maximum value (4,750 g/m) at Station 2 (moderately polluted). Biomass values decreased through Station 7 (fairly clean). A Biotic Quality Index was devised to allow for the use of information revealed by the species composition of a community. This index is only directly applicable to the lake system for which it was devised, but it can be used for any future assessment of the area. (McKeon-FRC)
W81-00634

THE EFFECT OF SAN FRANCISCO'S WASTEWATER PLAN ON WATER QUALITY AND AQUATIC BIOLOGY,
California Univ., Los Angeles.
For primary bibliographic entry see Field 5F.
W81-00647

THE EVOLUTION OF THALLUS FORM AND SURVIVAL STRATEGIES IN BENTHIC MARINE MACROALGAE: FIELD AND LABORATORY TESTS OF A FUNCTIONAL FORM MODEL,
California Univ., Irvine. Dept. of Ecology and Evolutionary Biology.
M. M. Littler, and D. S. Littler.
The American Naturalist, Vol 116, No 1, p 25-44, July, 1980, 4 Fig, 3 Tab, (California Water Resources Center Project UCAL-WRC-W-491). OWRT-A-054-CAL(13).

Descriptors: *Marine algae, *Benthos, *Biological communities, *Ecology, Plant morphology, Algae, Evolution, Laboratory tests, Synthesis, On-site investigations.

Morphological attributes of algae have long been considered primarily from the standpoint of taxonomy and used to discover new species or to speculate on phylogenetic affinities. While these approaches are of value, a fresh outlook that synthesizes the adaptational significance of algal structure, ecology, and physiology is needed. The present research explores the general concept that morphology, ecological attributes, and productivity are interrelated and synthesizes the adaptive significance of thallus form relative to the productivity ecology and survival of benthis macroalgae. (Snyder-Calif)
W81-00706

SOURCES OF VARIABILITY IN MACROALGAL PRIMARY PRODUCTIVITY: SAMPLING AND INTERPRETATIVE PROBLEMS,
California Univ., Irvine. Dept. of Ecology and Evolutionary Biology.
M. M. Littler, and K. E. Arnold.
Aquatic Botany, Vol 8, p 141-156, 1980. 4 Fig, 1 Tab, 42 Ref, (California Water Resources Center Project UCAL-WRC-W-491). OWRT-A-054-CAL(14).

Descriptors: *Marine algae, *Primary productivity, *Aquatic algae, Sampling, Data collections, Variability, Growth rates, Environmental effects, Respiration, Plant physiology, Reproduction.

Previous macroalgal production studies have been plagued by broad ranges of variability within experimental replicates that often exceed the seasonal or other parameters under investigation. As a first step toward understanding the factors responsible, eight rocky intertidal and subtidal macroalgae were examined for intrinsic sources of variation in photosynthetic performance and respiration relative to season, age, thallus part, reproductive state, external morphology, crowding, macrohabitat, microhabitat, desiccation, and physical injury. An understanding of variations such as those documented in this study is necessary for accurate analyses of macroalgal energetics and for the development of predictive insights into evolutionary strategies of carbon allocation. Therefore, much of the previous research on marine macroalgal productivity should be re-assessed in view of difficulties arising from environmental and intrinsic sources of metabolic variation. (Snyder-Calif)
W81-00707

EFFECT OF MILD TANNERY POLLUTION ON GROWTH AND EMERGENCE OF TWO AQUATIC INSECTS RHITHROGENA SEMICOLORATA AND EMPHEMERELLA IGNITA,
Paisley Coll. of Technology (Scotland). Dept. of Biology.
J. D. Hamilton, and J. Timmons.
Water Research, Vol 14, No 7, p 723-727, July, 1980. 4 Fig, 1 Tab, 12 Ref.

Descriptors: *Water sampling, *Tannery wastes, *Aquatic animals, *Mayflies, Benthic fauna, Water pollution effects, Streams, Water quality, Growth rates, Aquatic insects.

Monthly collections were made of aquatic invertebrates from a stony stream bed above and below a partially treated tannery effluent. Analyses of water samples indicated only slight differences in water quality parameters between the two sampling sites. It was concluded from findings in the analyses that mild tannery pollution which is sufficient to alter the species composition of the benthic invertebrate community did not influence the life histories and growth characteristics of the mayflies Rhithrogena semicolorata and Ephemerella ignita. It is suggested that this is likely to be the finding in the recovery zone downstream from severe organic pollution. However, this suggestion has not yet been tested on a suitable river with a heavy organic load and a natural re-purification pattern. (Baker-FRC)
W81-00741

AN INVESTIGATION INTO THE LONG-TERM EFFECTS OF RHINE WATER ON RAINBOW TROUT,
Netherlands Waterworks, Rijswijk. Testing and Research Inst.
C. L. M. Poels, M. A. Van der Gaag, and J. F. J. Van de Kerkhoff.
Water Research, Vol 14, No 8, p 1029-1035, August, 1980. 9 Fig, 2 Tab, 30 Ref.

Descriptors: *Toxicity, *Water pollution, *Rainbow trout, Rivers, Industrial wastes, Domestic wastes, Agricultural wastes, Fish physiology, Chlorinated hydrocarbon pesticides, Growth rates, Groundwater, Water quality, Rhine river, *Netherlands.

The possible negative influences of Rhine river water on rainbow trout (Salmo gairdneri) were evaluated. Trout were maintained in basins containing Rhine water (from the Lek River, a branch of the Rhine delta in the Netherlands) or ground-

water of drinking water quality for 18 months. When compared to trout kept in groundwater, those kept in Rhine water showed an inhibition of growth ($p < 0.005$ for weight and $p < 0.0005$ for length after 18 months), enlarged liver ($p < 0.05$ after 1 month) and kidneys ($p < 0.005$ after 9 months), reduced hemoglobin levels ($p < 0.005$ after 18 months), increased blood glucose levels ($p < 0.005$ after 12 months), a significant accumulation of chlorinated hydrocarbons in adipose tissue, and histological changes in the spleen and liver. It was concluded that Rhine water was chronically toxic to rainbow trout. These data support other experiments suggesting that the disappearance of the salmonids from the Rhine is due to the heavy pollution of this river from domestic, industrial, and agricultural wastes. (Geiger-FRC)
W81-00743

AN ECOLOGICAL RISK INDEX FOR AQUATIC POLLUTION CONTROL. A SEDIMENTOLOGICAL APPROACH,
National Swedish Environment Protection Board, Uppsala (Sweden). Water Quality Lab.
L. Hakanson.
Water Research, Vol 14, No 8, p 975-1001, August, 1980. 5 Fig, 23 Tab, 51 Ref.

Descriptors: *Mathematical models, *Heavy metals, *Water pollution, *Sediments, *Environmental effects, Lakes, Chemical analysis, Mercury, Cadmium, Copper, Chromium, Zinc, Polychlorinated biphenyls, Lead, Arsenic.

The development of an ecological risk index to be used as a diagnostic tool for determining the degree of pollution in lakes and basins is presented. The approach taken focuses on lake sediments and parameters that may be determined in a rapid, inexpensive and standardized manner from a limited number of sediment samples. The risk index was based on the following four requirements: (1) the ratio between the mean content of superficial sediment samples and the natural background levels of a particular toxic substance. (2) Toxic substances selected for measurement were PCB, Hg, Cd, As, Cu, Pb, Cr, and Zn. A number requirement was developed by summing the contamination factor for all selected toxic substances present in the sediment. (3) A sedimentological toxic factor was developed for each substance based on the individual toxicity of the substances selected. (4) The fact that different lakes and basins have different sensitivity to different toxic substances led to the development of the 'sensitivity factor.' These four requirements were developed into the potential ecological risk index. Risk index analysis results for 15 Swedish lakes of varying size, pollution status, and trophic status were presented. (McKeon-FRC)
W81-00747

EFFECTS OF STREAMBANK MATERIALS ADDITIONS UPON MICROBIAL ACTIVITIES OF TWO SUB-ARCTIC CANADIAN RIVERS,
Simon Fraser Univ., Burnaby (British Columbia). Dept. of Biological Sciences.
L. J. Albright, K. V. Masuda, and G. L. Ennis.
Water Research, Vol 14, No 9, p 1363-1366, September, 1980. 5 Tab, 7 Ref.

Descriptors: *Rivers, *Sediments, *Dissolved oxygen, *Respiration, *Subarctic, Ice breakup, Aquatic productivity, Primary productivity, Microorganisms, Algae, Canada.

The dissolved oxygen (DO) levels and respiration rates of the Ogilvie and Swift rivers were evaluated at various times of the year as influenced by streambank and sediment additions in the context of microbial and bacterial biomasses and activities. In both rivers, levels of DO dropped significantly from early fall (9-15 mg/liter) to late winter (3-11 mg/liter) and remained at relatively high concentrations during the ice-free seasons of late spring following ice breakup (8-12 mg/liter) and summer (10-12 mg/liter). In late winter the experimentally determined respiration rates for both rivers were in the range of 0.023-0.048 mg 02/liter/day. When the river waters were treated with several soil horizon materials the respiration rates were markedly influenced. Most treatments > 0.10 g of streambank material/liter of water significantly increased oxygen utilization by the native aquatic microorganisms. Algal and heterotrophic productivities were also significantly increased. It is suggested that these rivers would tend to be most sensitive to pipeline related construction activity that would result in streambank and sediment materials additions in winter and least sensitive in late spring, following ice breakup, and early summer. (McKeon-FRC)
W81-00750

5D. Waste Treatment Processes

UV-OZONE AND UV-OXYGEN PROCESSES FOR COLOR REMOVAL FROM TEXTILE DYEING AND FINISHING WASTEWATERS,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
C. P. C. Poon, and B. M. Vittimberga.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127417, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, (1980), 22 p, 12 Fig, 7 Tab. OWRT A-071-RI(1), 14-34-0001-9042.

Descriptors: *Waste water treatment, *Textiles, *Dyes, *Color removal, *Photoactivation, Acetone, Chemical reactions, Biochemistry, Pigments, Acids, Dissolved oxygen, Industrial wastes.

Photochemical degradation of dye molecules was studied by exposing solutions with acid, direct and dispersed dyes to UV. Acetone as a high triplet energy sensitizer enchanced the color removal rate by more than 100 times. Dissolved oxygen was an energy quencher which could be removed by N2 bubbling. N2 bubbling also provided adequate mixing to bring the dye molecules in closer contact with the radiation source. The only adequate means of measuring color removal was to measure color units as described by the American Dye Manufacturer's Institute (ADMI) because the color and its predominant wavelength changed in the course of photodegradation. Studies of continuous flow models included a tray model as well as single, and multi-column models. A tray model was found less effective. Single and multiple-column models were equally effective for some acid dyes but the multiple-column model was more efficient for resistent dyes. The power consumption per unit volume of dye solution treated was calculated for all dyes.
W81-00503

STUDY OF THE POTENTIAL FOR WATER REUSE IN THE STEEL INDUSTRY,
Hydrotechnic Corp. New York.
For primary bibliographic entry see Field 3E.
W81-00513

FILTRATION SYSTEM FOR HOUSEHOLD SEWAGE,
Great Circle Associates, Walnut Creek, CA. (Assignee).
S. B. Mullerheim, and F. G. Williams, Jr.
U.S. Patent No 4,191,647, 17 p, 14 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 992, No 1, p 247, March 4, 1980.

Descriptors: *Patents, *Wastewater treatment, *Water pollution treatment, Domestic wastes, Filtration, Oxidation, Equipment, Instrumentation, On-site disposal system, Composting, Liquid level sensors.

A method and apparatus for treating wastewater such as sewage are disclosed. Designed principally for complete on-site wastewater treatment and disposal, the system separates wastewater into liquid wastes and solid wastes by filtration, treats the liquid wastes with a mild oxydizing agent and disperses them into unsaturated ground. The solid wastes are periodically removed, along with used portions of the paper filter medium and delivered, in the case of sewage, to a composting area where the still-fresh solids can be aerobically composted. Preferred and particularly advantageous embodiments of a filtering system, a sewage delivery system, a vacumm generating system, and a liquid level sensor, each of which may be used with the invention, are disclosed. (Sinha - OEIS)
W81-00526

SELF WASHING BELT STRAINER,
Q. L. Hampton.
U.S. Patent No 4,191,653, 5 p, 7 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 992, No 1, p 249-250, March 4, 1980.

Descriptors: *Patents, *Waste water treatment, Equipment, Sewage treatment, Screens, Filtration, Cleaning, Self-cleaning.

An endless driven belt strainer is adapted for use as a porous barrier in a channel containing a flowing liquid, such as a channel supplying raw sewage to a treatment plant. The belt strainer is composed of a number of endless porous wire or plastic screen strips arranged in side-by-side relation and which pass over a driving roller, guide rollers and a tension adjusting roller, all of which rotate in a frame having an upwardly inclined bottom portion which slopes away from the direction of flow of liquid to be cleaned. A top portion located above the liquid level is equipped with cleaning means for removing foreign matter from the belt strainer as it commences its return travel. Each porous strip is twisted 180 degrees during the initial part of its return travel above the flowing stream, so that during a subsequent downward travel of these screen portions the freshly cleansed liquid will pass through the downwardly traveling flight portion for removing any debris clinging to its outer surface. An additonal endlessly driven cleaning device operates in front of the upwardly traveling screening surface for removing particles which cannot pass through the screen and are too large or of a nature such that they will not be taken out of the channel by the screen alone. (Sinha - OEIS)
W81-00527

TWO ZONE PROCESS FOR BIOLOGICAL TREATMENT OF WASTE WATER,
Canadian Liquid Air Ltd., Montreal (Quebec). (Assignee).
G. Savard, R. G. H. Lee, and D. Hornsey.
U.S. Patent No 4,192,740, 21 p, 13 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 625-626, March 11, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Biological treatment, Water purification, Biochemical oxygen demand, Oxygen, Microorganisms, Equipment, Monitoring.

A process is provided for treating waste water biological and clarifying the biologically treated water in a single vessel rather than in separate vessels. It is possible to treat water in this system containing much higher concentration of waste. In the process the supply of oxygen to the biological reaction zone is carefully monitored to meet the biological oxygen demand and avoid the occurrence of undissolved oxygen in the form of gas bubbles in the biological reaction zone or the clarification zone. Further improvements are provided in oxygen dissolving devices rendering them especially suitable for the two zone treatment. (Sinha - OEIS)
W81-00528

PROCESS AND APPARATUS FOR THE BIOLOGICAL TREATMENT OF WASTE WATER,
Degremont S.A., Rueil-Malmaison (France). (Assignee).
J. Bernard, J. Bebin, and J-P. Hazard.
U.S. Patent No 4,192,742, 8 p, 1 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 626, March 11, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Biological treatment, Filtration, Biochemical oxygen demand, Oxygenation, Equipment, Filters, Superoxygenation.

Waste water to be treated is introduced into an enclosed gas tight oxygenation chamber. An oxygen-containing gas is also introduced into the

chamber at a pressure higher than atomospheric pressure so that oxygen is dissolved in a quantity higher than the saturation concentration value of oxygen in the waste water at atmospheric pressure, thereby superoxygenating the waste water. The superoxygenated waste water maintained at higher pressure is then passed into an enclosed gas tight filtering chamber which is separate from the oxygenation chamber and which is also maintained at higher pressure. No other oxygen is introduced and the superoxygenated waste water is passed through a biological filter bed thereby biologically purifying the waste water which is then removed from the filtering chamber. (Sinha - OEIS)
W81-00529

RECLAMATION OF CEMENT SLURRY,
Fowlerex Pty. Ltd., Brookvale (Australia). (Assignee).
M. G. Hood.
U.S. Patent No 4,192,745, 8 p, 5 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 628, March 11, 1980.

Descriptors: *Patents, *Waste water treatment, *Industrial waste, Water pollution treatment, Separation techniques, Suspended solids, Water reuse, Cements, Equipment, Cement slurry, Concentration.

The invention provides a machine which concentrates the slurry and stores the concentrated slurry as a suspension of more or less consistent density throughout so enabling the concentrated slurry to be remixed into fresh concrete and preventing the settling and build up of sludge which otherwise occurs in the pits. Thus the machine has the ability to accept slurry from settling pits or aggregate reclamation plant, to separate the cement from most of the water, to store the separated material and to allow relatively clean water to flow back into the pits. Both the concentrated slurry and the water may be reused in fresh concrete. (Sinha - OEIS)
W81-00530

LIQUID CLARIFICATION SYSTEM,
K. S. Arvanitakis.
U.S. Patent No 4,192,746, 13 p, 11 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 628, March 11, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Separation techniques, Water purification, Chemical reactions, Chemical precipitation, Filtration, Equipment.

This invention relates to a liquid/solids separation system utilizing a settling clarifier to remove solid material suspended in a liquid through the introduction of chemicals and inert solids to accelerate the settling rate or precipitation of the solids from the liquid. The effluent discharge may be further processed, discharged, or recycled depending upon the nature of the effluent. The semi-solids material which is settled or precipitated is passed to a storage reservoir where this material is further processed in order to obtain predetermined uniform quantity of solids material in the sludge. This material is then discharged into a filtration system where the solids are utilized to form a filter cake on the septum of the system filters with the filtrate being discharged for further processing, disposal or reuse depending upon the nature of the liquid. (Sinha - OEIS)
W81-00531

SELECTIVE MULTIPLE ELECTRODE WASTE WATER TREATING SYSTEM,
A. S. King.
U.S. Patent No 4,193,859, 5 p, 2 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 992, No 3, p 1000-1001, March 18, 1980.

Descriptors: *Patents, *Waste water treatment, Water pollution treatment, *Electrodes, *Flocculation, Selectivity, Integrated control measures, Equipment.

A number of individual treaters, each containing a pair of oppositely charged electrodes, are arranged circularly around a tank into which all of the treaters empty. A common supply manifold for all of the treaters brings waste water into the system for treatment by any selected one of the treaters upon opening a control valve associated with the treater and closing control valves associated with the remaining treaters. Each treater contains an electrode that is constructed from a material differing from that in the remaining treaters so that a particular treater may be selected for use based upon the predicted reaction of the material from which its electrode is made with the particular constituents of the waste liquid being treated. The central tank into which all treaters empty includes a pair of oppositely charged electrodes of its own to expose the once treated liquid to yet a second electric field, and there is a special structure associated with the lowermost discharge end of the electrode pair within the tank which is so arranged and configured that it reduces turbulence adjacent the floor of the tank to encourage settling out of floc produced by the treating process. (Sinha - OEIS)
W81-00532

FERRITE FLOCCULATING SYSTEM,
General Electric Co., Schenectady, NY. (Assignee).
G. M. J. Slusarczuk, and R. E. Brooks.
U.S. Patent No 4,193,866, 5 p, 1 Fig, 1 Tab, 4 Ref; Official Gazette of the United States Patent Office, Vol 992, No 3, p 1003, March 18, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Suspended solids, *Flocculation, Separation techniques, Organic compounds, Magnetic ferrite.

The invention relates to the purification of aqueous polluted liquid containing suspended particulate impurities by adding a magnetic ferrite powder which is suspendible in the liquid and then adding an aqueous flocculating solution comprised of an aqueous solution of polyethyleneimine for co-flocculating the particulate suspended impurities and the magnetic powder and producing a dense flocculated mixture which settles rapidly in a matter of minutes. (Sinha - OEIS)
W81-00533

WASTEWATER AND WASTEWATER SOLID PROCESSING SYSTEM,
M. Brucker, R. J. Matika, and M. E. McMican.
U.S. Patent No 4,193,869, 16 p, 11 Fig, 24 Ref; Official Gazette of the United States Patent Office, Vol 992, No 3, p 1003-1004, March 18, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Domestic wastes, Separation techniques, Sludge treatment, Filtration, Coagulation, Evaporation, Water reuse.

The invention is a system for processing wastewater and wastewater solids. It accepts wastewaters such as domestic or industrial sewage, food-processing wastewaters and associated solid matter, and other wastewaters of like nature. It removes a substantial fraction of the solid matter contained in suspension, dewaters the solid matter, transports the pressed solid matter to a storage facility for further processing or optionally for immediate disposal, optionally further processes the solid matter to produce a soil supplement or subjects solids to microwave treatment which renders the material sterile. The system clarifies the influent wastewaters by a water separator and air flotation units, both with and without the use of chemical coagulants as the case may be, and discharges the clarified wastewaters at this stage of treatment, or alternatively transports the clarified wastwaters to a filter unit or a filter bed unit which completes the treatment process by evaporating or transpiring pure water to the atomosphere while absorbing all contaimants in the filter bed media. The physical-chemical system processes the wastes in 60 minutes or less thus preventing the waste from ever going septic and eliminating the need for large tanks. (Sinha-OEIS)
W81-00534

APPARATUS FOR CLARIFYING LIQUID,
Envirotech Corp., Menlo Park, CA. (Assignee).
M. J. Lillywhite.
U.S. Patent No 4,193,877, 9 p, 7 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 992, No 3, p 1006, March 18, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Sewage treatment, Activated sludge, Separation techniques, Skimming, Equipment.

An apparatus for clarifying liquid waste has a tank with a center column mounted in its center and suction pipes to remove sludge which has settled to the floor of the tank. The center column is provided with an influent trough to introduce liquid waste into the tank, and ports are formed in the upper part of the column to introduce waste into the influent trough. The ports and the influent trough are located at about the level of the liquid in the tank so that the waste leaving the ports creates a radially outward current on the surface of the liquid in the tank to carry scum towards the periphery of the tank for collection. (Sinha - OEIS)
W81-00535

SAVING THE LAKES,
Washington State Water Research Center, Pullman.
For primary bibliographic entry see Field 2H.
W81-00549

TREATMENT OF INDUSTRIAL LIQUID WASTES BY ELECTROFLOTATION,
Salonika (Greece).
K. A. Matis.
Water Pollution Control, Vol 79, No 1, p 136-142, 1980. 5 Fig, 11 Ref.

Descriptors: *Flotation, *Waste water treatment, *Sludge treatment, *Design data, *Electrical design, Coagulation, Electrolytes, Biological treatment, Separation techniques, Gases, Anodes, Cathodes, Membranes, Industrial wastes, Laboratory tests, Hydrogen ion concentration, Sea water, Suspended solids, Biochemical oxygen demand.

Batch tests and continuous flow experiments were conducted in a laboratory using an emulsified oil dispersion and an alum dilution to obtain data to evaluate the design and effectiveness of a continuous flow electroflotation sludge thickening unit. Electroflotation is used to reduce BOD and suspended solids in industrial effluents. Results showed a retention period of 55 min in continuous operation and 30-min retention period in batch tests. The continuous flow experiments showed the reduction in concentration to be about 90% at a current density of 300 A/sq m. The feed concentration ranged from 1,000-1,500 mg/liter, and the effluent contained 100-150 mg/liter. As with air flotation and sedimentation, the performance of the electroflotation unit depends upon inlet design which is critical to the reduction of turbulence and maintenance of intact bubbles. With horizontal electrodes separated by a membrane, it was observed that one gas activates the process while the other contributes to the transfer of coagulated matter. A saving of electricity was observed. pH was determined to be significant when seawater is the electrolyte. The retention period and the effluent concentration are strongly dependent on pH, and flotation rates are high within a narrow pH range. Further research could improve bipolar cell design and maximize generation of gas. (Titus-FRC)
W81-00567

EXPERIENCES OF HIGH-RATE BIOLOGICAL FILTRATION AT DERBY SEWAGE-TREATMENT WORKS,
Severn-Trent Water Authority Birmingham (England). Derwent Div.
P. B. Smith, and D. Yates.
Water Pollution Control, Vol 79, No 1, p 87-98, 1980. 1 Fig, 5 Tab, 3 Ref.

Descriptors: *Waste water treatment, *Odor, *Filtration, Sludge, Pre-treatment, Trickling filter, Or-

ganic loading, Protozoa, Anaerobic conditions, Nitrates, Treatment facilities, Biochemcial oxygen demand, Biological treatment.

A high-rate biological filtration unit was built at Derby, England using Flocor E plastic media in an attempt to remedy the overloaded existing system. Constructed between July, 1973 and September 1975, the plant consists of 6 filter units, 24m in diameter and 3m deep, each containing 1,132 cu m of medium. One of the filters was divided into quadrants and was used for an experimental comparison of Flocor E media against three other competitive media. The work at Derby has demonstrated that high-rate biological filtration is an economically viable process, and when at an intermediate stage, is capable of significant reductions in the applied organic loading. All four media achieved 40% BOD removal by July, 1976. It produced an effluent suitable for further treatment by normal low rate biological filtration, giving a corresponding improvement in effluent quality. Problems arose with regard to sludge production, which was higher than expected and produced significant effects on other treatment units. The unit was forced to cease operation in December, 1976 when the surrounding community complained of a severe odor, the exact cause of which has not yet been ascertained. The compound could be a biological-degradation product, could be present in the original feed liquor, or could be a consequence of synergistic interactions with other chemicals discharged in the vicinity. A discussion of this paper is also presented. (McKeon-FRC
W81-00568

A STUDY OF THE PROTOZOAN AND METAZOAN POPULATIONS OF THREE OXIDATION DITCHES,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
J. E. P. Poole, and J. C. Fry.
Water Pollution Control, Vol 79, No 1, p 19-27, 1980. 10 Tab, 15 Ref.

Descriptors: *Protozoa, *Metazoa, *Oxidation lagoons, Biomass, Suspended solids, Biochemical oxygen demand, Activated sludge, Rotifers, Nematodes, Sewage treatment, Water quality, Sewage effluents.

The protozoan and metazoan populations inhabiting three oxidation ditches over a 1-mo period compared with those reported to occur in activated-sludge plants. The relationship between protozoan species in the mixed liquor and the BOD of the final effluent is also examined. Oxidation ditches appeared to support populations of peritrichs, crawling ciliates, bdelloid rotifers, nematodes, and aeolosomatid oliogochaetes. If high concentrations of mixed-liquor suspended solids were maintained, the biomass of nematodes and aeolosomatids far exceeded that of protozoa. Large populations of protozoan species were found that rarely occur in conventional activated-sludge plants, and relatively larger populations of metazoa were also found in the oxidation ditches. The abundance of protozoan species was found to fluctuate over as little as 11-14 days, nevertheless the monthly average BOD in the final effluent could be predicted from the protozoan species present in the mixed liquor. In a discussion following the article, it is noted that the presence of a more varied metazoan population in the oxidation ditches was primarily due to the longer retention periods than those in activated-sludge plants. It is also explained that there were few differences between the sludges except for a higher concentration of suspended solids in one of the ditches. (McKeon-FRC)
W81-00573

SEWAGE DISPOSAL IN DEVELOPING COUNTRIES: SOME THROUGHTS,
Allott and Lomax, Manchester (England).
R. Foster.
Water Pollution Control, Vol 79, No 1, p 28-41, 1980. 13 Fig.

Descriptors: *Sanitary engineering, *Sewage treatment, *Domestic wastes, *Environmental sanitation, Septic tanks, Sewers, Regional economics, Sewerage, Biological treatment, Governments, Municipal wastes, Water requirements, Economic feasibility, Africa, History.

The history of the sewerage system in the United Kingdom is reviewed and contemporary sanitation projects in selected developing countries are described. In the Middle Ages sanitation ranged from the midden heap and the privy to the Rochedale system in which disinfected pails in outhouses were transferred to processing plants by vans. Water closets developed in the late eighteenth century improved domestic health by removing waste from houses, yet caused pollution of rivers used as sewers. Sewage treatment began in the late nineteenth century. The present state of technology with computer controlled plants and biological treatment is an outgrowth of the water-carriage system which has historical roots. In developing countries sanitation problems include limited water, funding, and architechture as well as tropical climates and scarce transportation. Appropriate facilities include variations on the pit latrine such as the vault latrine with watertight composting, the aqua privy with a water-filled pit, and the septic tank which accepts all domestic waste and connects to internal plumbing. Cities in Saudi Arabia and Ghana have recently constructed water-carriage systems to accommodate the needs of large, high density populations and make use of available water. Similar sanitation options are under study in Nigeria, where cost constraints, the necessity of property demolition and education programs are complicating factors. (Titus-FRC)
W81-00574

RECOVERY OF PROTEIN AND FAT FROM FOOD INDUSTRY WASTE WATERS,
Alwatech Ltd., High Wycombe (England).
A. P. Hopwood.
Water Pollution Control, Vol 79, No 2, p 225-235, 1980. 4 Fig, 11 Tab, 13 Ref.

Descriptors: *Sludge disposal, *Environmental sanitation, *Food processing industry, *Waste water treatment, *Industrial wastes, Soil contamination effects, Recycling, Pollutants, Treatment facilities, Chemical precipitation, Biochemical oxygen demand, Suspended solids, Coagulation, Proteins, Dewatering, Drying, Animal diseases, Microorganisms, Lipids, Flocculation, Economics.

With the increasing demand for the slaughter of animals for human consumption, new methods must be found to control the pollution connected with waste water from abattoirs and meat and poultry packing plants. Animal proteins may be recovered from waste water by precipitation with purified lignosulphonates (LS). LS are a byproduct of sulphite cellulose production and occur in sulphite lye. A complete primary waste-water treatment system for food industry effluents has been developed using the LS method. Several LS plants have been in full-scale operation for about seven years. Average percent removals of BOD, suspended solids, and free oil and grease over a 10-day period from the waste water of a beef abattoir using the LS treatment was 79, 87, and 95%, respectively. LS precipitated proteins have been used as animal food additives with no adverse effects when the LS concentration in the total diet is below 3%. The heat coagulation, dewatering and heat drying steps of the LS process are effective in removing viable microorganisms thus reducing the risks of animal disease transfers. Water recycling in LS processing seems feasible, however the fact that it is not natural water has prevented the EPA from allowing its use for human consumption. The major advantage of protein and fat recovery by LS treatment is the elimination of offsite sludge disposal. The economics of the process in the United Kingdom and the effectiveness of various flocculants are also mentioned in a discussion following the article. (Geiger-FRC)
W81-00580

OILY EFFLUENT TREATMENT BY THE BP TREATMENT PROCESS,
British Petroleum Co. Ltd., London (England).
G. F. Oldham.
Water Pollution Control, Vol 79, No 2, p 236-243, 1980. 1 Tab.

Descriptors: *Oil wastes, *Biological treatment, *Filtration, *Waste water treatment, *Water pollution treatment, Sludge disposal, Polyelectrolytes, Incineration, Dewatering, Flocculation, Pilot plants, Operating costs, Activated sludge, Phenols, Sulfides, Installation costs, Industrial wastes, Costs, Flotation.

Conventional treatment of oily effluents from refineries or petrochemical factories consisted of flocculation and/or flotation with adsorption onto flocs such as ferric hydroxide and treatment of activated sludge by thickening, dewatering and incineration. In the early 1970s, the British Petroleum (BP) Sweden refinery was required to meet a treated effluent quality of 5 mg/liter oil, 21 mg/liter BOD, and 1 mg/liter standards for phenols and sulfides. Since the existing biological treatment had several flaws, chemical flocculation with ferric salts was examined as an alternate treatment. This method brought problems of sludge removal, so biological filtration and activated sludge treatment were considered. Biological filtration was found to have important advantages over activated sludge with regard to high inlet temperatures, pH variations, sudden density changes, and turn-down ratios. Biological filtration can be fully automated thus reducing operating costs. The filters for biological treatment were also cheaper than activated sludge. Results at pilot plants and full scale operations using granular filtration treatment of oily effulents were good. Oily emulsions can be treated by polyelectrolytes to produce waters suitable for biological filtration. Installation costs of the BP process plants were about 40% of those of conventional treatment sites, including incinerators. Operational costs of the BP facilities were approximately 5% of those of conventional processes. Effluents that have been treated by the BP technique include those from simple refineries to complex refineries with oil terminals and ballast water. Successful pilot tests have also been run on petrochemical effluents and North Sea oil ballast water at low temperatures and high salt content. An Extensive discussion follows the article. (Geiger-FRC)
W81-00581

UPRATING ACTIVATED-SLUDGE PLANTS USING ROTARY BIOLOGICAL CONTACTORS,
Philadelphia Water Dept., PA. Water Pollution Control Div.
C. F. Guarino, M. D. Nelson, M. Lozanoff, and T. E. Wilson.
Water Pollution Control, Vol 79, No 2, p 255-271, 1980. 7 Fig, 17 Tab.

Descriptors: *Aerobic treatment, *Sewage treatment, *Activated sludge, Pilot plants, Microorganisms, Biological treatment, Operating costs, Settling velocity, Aeration, Biomass, Energy, Conservation, Sewage sludge.

The uprating of the Philadelphia sewage treatment plants by the adoption of the Surfact process is described. Surfact physically merges a rotating biological contactor (RBC) with a diffused air aeration tank which results in the ablity to handle large biomass at low energy costs with little maintenance. Discs could be placed into existing aeration tanks as soon as supports were constructed. Preliminary pilot-scale studies were conducted in 1974 to determine whether the RBC units would rotate when placed in aeration tanks. Favorable results were achieved. A full-scale RBC caused the media to rotate with the surface hyraulic motion which allowed minimal energy requirements. When a prototype system was examined through six modes, similarities were found between the Surfact and the conventional activated-sludge system. During the 11 months of Surfact operation, surface biology studies, soluble BOD profiles, settling tests, disc rotation experiments, and power consumption evaluations were conducted. Discs supported a growth equivalent to 1,500 mg/liter mixed liquor suspended solids. Microbial populations of disc solids and suspended cultures were nearly the same and resembled those found in activated sludge. Sludge settlement demonstrated initial velocities of 5.8 m/hr. The present proto-

type had some oxygen limitations that are currently being corrected. Step feeding processes will be implemented to reduce solids overloading of the final clarifier and disperse the organic load to all discs. Upgrading to Surfact may be accomplished rapidly, and its low costs of operation make it an attractive choice for the construction of new secondary facilities. A discussion follows the article. (Geiger-FRC)
W81-00582

EXPERIENCE IN OPERATING THE DEEP-SHAFT ACTIVATED SLUDGE PROCESS,
Anglian Water Authority, Huntingdon (England). Essex Sewage Div.
O. C. Collins, and M. D. Elder.
Water Pollution Control, Vol 79, No 2, p 272-285, 1980. 3 Fig, 2 Tab, 6 Ref, 1 Append.

Descriptors: *Denitrification, *Sewage treatment, *Activated sludge, Foaming, Surfactants, Sludge disposal, Settling velocity, Biological treatment, Organic wastes, Biochemical oxygen demand, Treatment facilities.

A deep shaft to treat sewage at the Marsh Farm, Tilbury Treatment Works, England was constructed to meet BOD standards of 60 mg/liter and to handle maximum daily loads of 7,050 kg BOD. The shaft was 130 m deep and 1.86 m in diameter and was designed for a sewage retention period of 1.5 hr at a maximum feed rate of 277 cu m/hr. The shaft was capable of removing high organic loads while producing an effluent which was acceptable for discharge to the estuarial River Thames. Problems with degassing and settlement still need to be overcome, but no foul odors or fly populations accompanied the process. The operation of the shaft requires considerable attention, but automation may solve this situation. Screening and degritting are necessary for effective treatment of crude sewage. The compact layout of the shaft allows easy access to operation areas. Sludge production has been much greater than was originally predicted, and difficulties exist in solids separation. In discussions following the article, mention is made of the problems of foaming to which the deep-shaft process lends itself. If surfactants are present in the sewage material, foaming becomes a great nuisance causing unsightly working conditions. To date the operation of the deep-shaft facility is very complex, and design standard effluents have not been consistently achieved. (Geiger-FRC)
W81-00583

FLUIDIZED- AND EXPANDED-BED REACTORS FOR WASTE-WATER TREATMENT,
Water Research Centre, Stevenage (England).
P. F. Cooper, and D. H. V. Wheeldon.
Water Pollution Control, Vol 79, No 2, p 286-306, 1980. 7 Fig, 7 Tab, 68 Ref.

Descriptors: *Denitrification, *Biological treatment, *Sewage treatment, *Waste water treatment, Reviews, Landfills, Water treatment, Potable water, Sewage sludge, Suspended solids, Industrial wastes, Particle size, Fluidized beds, Expanded beds, Carbon, Sewage effluents.

The state of the art of fluidized- and expanded-bed technology is reviewed with a brief account of work at the Water Research Centre's (WRC) Stevenage Laboratory in England in denitrification of sewage effluents using expanded beds. This method of removing the non-settleable organic content of sewage reduces considerably the size of treated biomass. At the WRC facility, methanol is used as the main carbon source in the reactor. Denitrification became linear with respect to time in the 1.0- to 3.0-m height zone, and the volumetric rate of removal in this part of the bed was 4.6 kg Oxd-N/cu m/day. Calculations of the sludge production rate showed that at a sludge age of 14 days, production was 0.17 g biomass volatile solids concentration/g methanol. It was possible to use settled sewage as the carbon source for denitrification in an anoxic fluidized bed with a conical distribution system. However, it was considered doubtful that an expanded-bed or fluidized system would operate successfully using settled sewage as the carbon source. The fluidized-bed system could be designed in modular fashion to replace easily an existing overloaded plant by a more powerful system. Sludge disposal from bed systems could be directed to landfills. The need for a clarification stage to handle suspended solids is still debatable. Fluidized beds will most likely be used for denitrification of river or bore-hole waters prior to potable water treatment, to update existing sewage treatment facilities, and to treat concentrated industrial wastes. A discussion follows the article. (Geiger-FRC)
W81-00584

THE CLARIFICATION OF EFFLUENT FROM AN ACTIVATED-SLUDGE PLANT USING DISSOLVED-AIR FLOTATION,
Universidade Federal do Rio de Janeiro (Brazil). Inst. de Quimica.
J. E. L. Maddock, and E. J. Tomlinson.
Water Pollution Control, Vol 79, No 1, p 117-125, 1980. 7 Fig, 4 Tab, 4 Ref.

Descriptors: *Flotation, *Activated sludge, *Sewage treatment, *Aerobic tratment, *Coagulation, Settling basins, Separation techniques, Water pollution treatment, Sludge, Turbidity, Effluents, Pilot plants.

A pilot-scale dissolved-air flotation (DAF) unit was designed and operated at the existing Peterborough sewage treatment works in England. The pilot unit was used to demonstrate that DAF after the secondary sedimentation basin could reduce suspended solids in the plant effluent to < 30 mg/liter of suspended solids (SS). The maximum hydraulic load which could be applied to the DAF unit while clarifying a dilute suspension of solids was approximately 12 cu m/sq m hr. This had to be reduced proportionately when the SS concentration was > 800/liter. The minimum sludge recycling rate required to promote satisfactory clarification of a dilute suspension by flotation was 7%. Increased rates were required when the SS concentration in the DAF feed exceeded about 400 mg/liter. Solids separated by floation were not removed effectively by scrapers even after modifications were made. The addition of coagulants and polymers did not reduce the SS in the effluent over that without any chemical addition (this was usually < 15 mg/liter). (McKeon-FRC)
W81-00587

DETOXIFICATION OF KRAFT PULPMILL EFFLUENTS BY FOAM SEPARATION.
Water and Pollution Control, Vol 118, No 9, p 18-20, September, 1980.

Descriptors: *Foam fractionation, *Bleaching wastes, *Waste water treatment, *Pulp and paper industry, Biodegradation, Surfactants, Pilot plants, aeration, Wood wastes, Economic feasibility, Sulfides, Organic compounds, Laboratory tests, Industrial wastes.

Foam fractionation is an alternative to biological processing of pulp and paper industry effluent which achieves detoxification at less expense. Sulfides, mercaptans, unsaturated fatty acids, resin acids, chlorinated organics and other wood extractives are among the substances in bleached effluents that are toxic to fish and other life. The foam fractionation process exploits the phenomenon that toxic surfactants are collected in the foam phase which is readily formed in aeration of bleached pulpmill effluent. The foam is collected and treated separately. Laboratory and pilot plant studies conducted during a 7-yr period in Vancouver, British Columbia determined that the surface area of foam generated must be proportional to the toxicity of the effluent and averages 30 sq m of area per liter effluent. The configuration of aerators within the foam stage is also critical. Detoxification is optimized with a three-stage system and a 20-min retention period in each stage. Conventional biological treatment of the extracted foam readily achieved detoxification. Eighty-three percent of 205 whole mill effluents were detoxified in less than 5 hr under laboratory conditions. Experiments suggest that this method has application throughout the bleach kraft industry and in particular in situations where land is expensive and reductions in treatment time are advantageous. (Titus-FRC)
W81-00597

USE OF THE DEEP-SHAFT-PROCESS IN UPGRADING AND EXTENDING EXISTING SEWAGE-TREATMENT WORKS,
Thames Water Authority, London (England). Vales Div.
G. C. Cox, V. H. Lewin, J. T. West, W. J. Brignal, and D. L. Redhead.
Water Pollution Control, Vol 79, No 1, p 70-86, 1980. 6 Fig, 5 Tab, 22 Ref.

Descriptors: *Pilot plants, *Municipal wastes, *Hydrostatic pressure, *Sludge digestion, *Sewage treatment, *Filtration, Depth, Nitrification, Construction costs, Toxins, Heavy metals, Waste dilution, Underground, Oxygenation, Biological treatment.

The deep shaft process of sewage treatment was tested in a pilot plant and evaluated for effectiveness in municipal sewage treatment. Findings indicate that this process is suited to areas with restricted land and to sewage with high carbon content. In the pilot plant the shaft extended to a depth of 61 m. Degritted sewage enters a settlement tank where anaerobic digestion, precipitation of heavy metals, and dilution take place. In the shaft, hydrostatic pressure is used to effect high oxygen transfer efficiencies. Carbon dioxide and nitrogen gas are released as bubbles. The effluent then undergoes degasification either through vacuum methods or bubble stripping followed by settlement and subsequent filtering for nitrification. Experiments revealed that both oxygen transfer efficiency and construction costs increase with the depth of the shaft. Effluent samples produced ranged from 72 to 96% nitrified depending on the degree of loading of the filters. On two occasions during the three month test period toxic discharges with abnormal pH occurred. This method is limited in its ability to dilute toxins because the volume of the shaft is lower than that of conventional sludge treatment systems. Development of a biological monitoring system for control of effluent is proposed. (Titus-FRC)
W81-00608

PRIMARY FLOCCULATION OF CADMIUM PLATING PLANT EFFLUENT: IMPROVED OCCUPATIONAL HYGIENE AND EFFLUENT QUALITY,
Hainsworth Research Centre, Hull (England).
A. Ashton.
Water Pollution Control, Vol. 79, No 3, p 421-424, 1980. 5 Fig, 2 Ref.

Descriptors: *Cadmium, *Industrial wastes, *Flocculation, Sulfates, Metals, Chemical precipitation, Chlorine, Hydrogen ion concentration, Water quality, Effluents, Water pollution sources, Laboratory tests, Toxicity.

Ferrous sulfate and aluminium sulfate were tested for use as primary flocculants of cadmium plating plant effluent in an effort to improve the quality of effluent and the poor occupational hygiene associated with a static drag-out. After destruction of the cyanide in a diluted sample of the plating effluent at a pH of 11.0 to 11.5 by the addition of a slight excess of hypochlorite, the flocculent under study was added until the pH was lowered to the desired level (9.5). Of the two flocculants, ferrous sulfate was somewhat superior with respect to rate of settlement, effective pH range, and effective concentration range. In addition, when ferrous sulfate was added, the pH was reduced as metal hydroxide was precipitated, and there was reduction in the level of available chlorine, both immediately and after standing for 1-2 hr. By using ferrous-sulfate flocculation in the treatment of dilute cadmium plating effluent, it should be possible to operate an electroplating plant with a flowing drag-out tank. In this way, occupational hygiene can be improved by avoiding batch treatment of heavily-contaminated effluents from static drag-outs. Effluent quality would also be improved with respect to cadmium, pH, and available chlorine levels. (McKeon-FRC)
W81-00614

ACTIVATED SLUDGE SETTLEMENT - SOME SUPPOSITIONS AND SUGGESTIONS,
Birmingham Univ., (England). Dept. of Civil Engineering.
C. F. Forster, and J. Dallas-Newton.
Water Pollution Control, Vol 79, No 3, p 338-351, 1980. 11 Fig, 5 Tab, 17 Ref.

Descriptors: *Sewage treatment, *Activated sludge, *Sewage sludge, Suspended solids, Design, Aerobic treatment, Microbiology, Waste water treatment, Flocculation, Coagulation, Settling basins.

The causes of poor settling characteristics of activated sludge are discussed along with laboratory measurements which can be used to predict the settleability of sludge. Settling rates are determined by the microbiology and the surface biochemistry of the sludge. In sludge dominated by filamentous species, the individual flocs are held apart in a huge three-dimensional matrix hindering both the downwards motion of the solids and the upward flow of liquid. In some sludges, a large repulsion factor due to surface biochemistry can hold the particles far enough apart to result in poor settling. A relationship was shown between the sludge volume index (SVI) laboratory measurement and chemical parameters which could affect the nature of the sludge surface. The SVI should be used as the prime operational index that can be used in conjunction with chemical parameters to predict bulking. The SVI should remain as an excellent design parameter, from which sludge recycle rates and sedimentation tank loading rates can be calculated. A discussion follows the presentation of the paper. (McKeon-FRC)
W81-00617

DEVELOPMENT OF THE BRISTOL REGIONAL SEWAGE-TREATMENT WORKS AND ASSOCIATED SEWERAGE SCHEME,
Wessex Water Authority, Bristol (England).
P. H. Steel.
Water Pollution Control, Vol 79, No 3, p 333-337, 1980. 3 Fig, 2 Tab, 5 Ref.

Descriptors: *Sewage treatment, *Sewage districts, *Sludge disposal, *Planning, Interceptor sewers, Cost allocation, Domestic wastes, Pumping plants, Hydraulic equipment, Sewers, Sludge digestion, Reservoir construction, Sewerage, Economics, Construction, Ultimate disposal.

The development of the Bristol, England regional sewerage and sewage-treatment scheme is described, future programs are identified, and priorities are suggested. Construction was begun in 1959 and was planned to be carried out in stages over a 20- to 30-year period to maintain an appropriate rate of expenditure given the expected increase in the contributing population. The plant is presently 65% complete. Extensions of the plant began in 1970 and included an activated sludge plant, a sludge digestion plant, an industrial-water reservoir, pumping station, and generating station. As a result of growth and increase in flow, both the hydraulic capacity and sedimentation capacity of the plant have declined, producing consequent declines in sludge and effluent recovery. Since 1968, over 900 tonnes/day of liquid digested sludge have been dumped in the deep water of Bristol Channel by ship. Future programs are designed to accomplish the initial objectives of removing all crude discharges and connecting outmoded sewers to the works. By 1995, certain interceptors shall be extended and constructed. It is suggested that adequate sludge treatment capacity be achieved by 1982 and that hydraulic deficiencies be remedied by 1984. This scheme is the most economical sewage-treatment works in the region and reflects both the benefit of size and lower standard of effluent required. In a discussion following the article, questions concerning costs and the safety of effluent discharge into the Bristol Channel are raised. (Titus-FRC)
W81-00618

BIOOXIDATION IN A CONTINUOUS ACTIVATED SLUDGE PROCESS,
Instytut Ksztaltowania Srodowiska, Katowice (Poland). Dept. of Water and Wastewater Treatment.
For primary bibliographic entry see Field 7B.
W81-00624

MICROBIAL VIABILITY MEASUREMENTS AND ACTIVATED SLUDGE KINETICS,
Oregon State Univ., Corallis. Dept. of Civil Engineering.
P. O. Nelson, and A. W. Lawrence.
Water Research, Vol 14, No 3, p 217-225, March, 1980. 6 Fig, 4 Tab, 39 Ref, 1 Append.

Descriptors: *Waste water treatment, *Model studies, *Biological treatment, *Activated sludge, Sewage bacteria, Organic matter, Adenosine triphosphate, Spectrometry, Laboratory tests, Kinetics, Slurries, Suspended solids, Volatility, Biodegradation, Waste treatment, Microorganisms, Biomass.

A laboratory investigation was conducted to determine the influence of microbial viability data on a frequently used steady-state kinetic model of slurry-type process of biological waste-water treatment. The luciferin-luciferase firefly lantern extract method coupled with a liquid scintillation spectrometer was used to measure adenosine triphosphate (ATP) levels as an indication of microbial viability. The microbial viability of activated sludge mixed liquor volatile suspended solids (MLVSS) was found to have a functional relationship with the retention time of the biological solids. Microbial viability of the MLVSS was essentially 100% at low bilogical solids retention times. Conversely, at higher values of biological solids retention time characteristic of normal activated sludge processes, The MLVSS microbial viability decreased to nearly a constant value. Microbial viability of the MLVSS also affected values of the model coefficients. It was concluded from mass balance studies and ATP values that the MLVSS of an activated sludge system treating a soluble organic waste could be composed of three distinct systems, namely active or viable microbial solids, inert microbial debris solids, and nonviable biodegradable microbial solids. (Geiger-FRC)
W81-00627

METHODS FOR DETECTION OF VIRUS IN WASTEWATER, APPLIED TO SAMPLES FROM SMALL SCALE TREATMENT SYSTEMS,
Royal Veterinary and Agriculture Coll., Copenhagen (Denmark). Dept. of Veterinary Virology and Immunology.
For primary bibliographic entry see Field 5A.
W81-00631

LABORATORY APPLICATION OF SECONDARY SEWAGE EFFLUENT TO ARGILLACEOUS LIMESTONE,
Guam Univ., Agana. Water Resources Research Center.
P. A. Cowan, and R. N. Clayshulte.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-137739, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No 18, 1980. 56 p, 14 Fig, 10 Tab, 44 Ref, 2 Append. OWRT B-002-GUAM(1), 14-34-0001-9066.

Descriptors: Sewage, *Sewage treatment, Sewage disposal, *Limestones, Sewage effluents, River, *Water quality control, Laboratory tests, Nutrient removal, Guam, Mariana Islands, Micronesia.

Secondary sewage effluent and river water (control) were applied to a series of laboratory lysimeter columns containing argillaceous limestone. Nitrates naturally deposited in the limestone were leached after semi-continuous water loading. Mass balance data of river water percolate with low nutrient input levels showed nitrogen removal and phosphorus release. Phosphorus release was attributed to fine particulate matter flushed from the lysimeters. River water leachate was generally high quality. Sewage effluents with high nitrate concentrations leached through the limestone media yeilding mean percolate concentrations of 8.0 plus or minus 0.4 and 14.3 plus or minus 8.7 mg/l at a depth of 2.74 m. the limestone was unable to remove nitrogen. Phosphorus was initially stripped from the sewage effluent with 76 to 90% removal after percolating through 2.74 m of limestone media. Phosphorus breakthrough occurred in the top 0.91 m of limestone after 70l of water loading. The estimated phosphorus adsorption capacity was low at 0.011 kg P/m sup 3. Coliform bacteria removal efficiencies in the sewage runs were >95% at the 0.91 m depth and >99% at the 1.83 m depth. In relation to the limestones' inability to remove nitrogen and phosphorus, the limestone infiltration/percolation system was concluded to be a disposal option and not a treatment alternative.
W81-00641

THE DEVELOPMENT OF CHLORINE RESISTANT ULTRATHIN FILM COMPOSITE MEMBRANES FROM SOLUBLE AROMATIC POLYIMIDE THIN FILMS ON POLYBUTYLENE TEREPHTHALATE SUPPORTS,
Purolator-Puropore, Tustin, CA.
R. E. Kesting, J. M. Newman, A. W. Brewer, and D. M. Tyler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138059, Price codes: A05 in paper copy, A01 in microfiche. Completion Report Prepared for Office of Water Research and Technology, 1980. 71 p, 5 Fig, 14 Tab, 111 Ref. OWRT-C-90298-D(No 9447)(1), 14-34-001-9447.

Descriptors: *Waste treatment, *Chlorination, *Membrane processes, *Reverse osmosis, *Water quality control, *Membranes, Water treatment, Water quality, Liquid wastes, Research and Development, Chemical reactions, Water purfication, Thin films, Filters, Disinfection, Degradation(Decomposition), Sulfur compounds, Sulfonates, Treatment facilities.

Disclosure of the first asymmetric cellulose acetate reverse osmosis (R0) membrane stimulated considerable interest in synthetic polymeric membranes. Commercial diaminophenylindane (DAPI) polyimides had specified properties indicative that they could be modified and converted into chlorine-resistant R0 membranes of both integrally skinned (asymmetric) and ultrathin film composite types, but DAPI-based polyamides showed a lack of resistance to degradation by both chlorine and chlorosulfonic acid. New support membranes of poly(butylene terephthalate), PBT, were shown to be resistant to chlorine and most organic solvents, and more wettable than polysulfone membranes. Membranes of PBT may prove an attractive alternative to polysulfone supports, especially if a replacement for the expensive hexafluoroisopropanol solvent can be found. PBT membrane pore size could be controlled by air velocity adjustment above the nascent membrane. Further, it was concluded that sulfonation was generally unsuited for increasing hydrophobic membrane polymer hydrophilicity, and that anionic-exchange type ionogenic R0 membrane polymers were superior to cationic types in both processing and end-use characteristics. Thus, future work will focus on polymers bearing quaternary ammonium groups, rather than sulfonate groups. (Zielinski-IPA)
W81-00679

A VARIABLE-DISCHARGE MODEL FOR FACULTATIVE OXIDATION PONDS,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
F. M. Saunders, and E. P. Minchew.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142135, Price codes: A07 in paper copy, A01 in microfiche. Environmental Resources Center, Georgia Institute of Technology Report ERC 04-80, June 1980. 122 p, 29 Fig, 7 Tab, 49 Ref, 1 Append. OWRT-A-076-GA(1).

Descriptors: *Mathematical models, *Ponds, *Oxidation lagoons, Discharge frequency, Rural areas, *Waste water treatment, Discharge(Water), Release, Outflow, Water quality control, Streams, Economic feasibility, Water purification, Water

pollution control, Wastes, Permits, Legal aspects, Waste treatment.

Waste water treatment facilities are granted discharge permits based on the ten-year seven-day low flow of the receiving stream; the low value for this parameter requiring that facilities be capable of achieving a high degree of waste water contaminant reduction. The costs associated with supplying a high degree of treatment and the expertise needed to operate such a system are generally lacking in small rural communities. This study demonstrated that a facultative oxidation pond operating according to a variable discharge schedule would be well-suited to rural communities. Lagoon discharge would be reduced to a minimum level during periods of low assimilative capacity of the stream; when the stream could receive heavier wasteloads without water quality degradation below specified standards, the excess lagoon accumulation volume would be gradually released, with the lagoon going through a complete cycle once a year. Such a variable-discharge oxidation pond would provide an economic/technically-feasible alternative for rural communities. The initial implementation cost is significantly lower than that of other processes capable of higher degrees of treatment, and the greater land availablity in rural areas is well-suited to lagoon construction. A field application study of the proposed model was recommended. (Zielinski-IPA)
W81-00680

ENHANCED SOLAR DRYING OF WASTEWATER SLUDGE,
Georgia Inst. of Tech., Atlanta. School of Nuclear Engineering.
T. F. Craft.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138034, Price codes: A03 in paper copy, A01 in microfiche. Environmental Resources Center, Georgia Institute of Technology Report ERC 05-80, September, 1980. 22 p, 8 Fig, 1 Tab, 7 Ref. OWRT-A-080-GA(1).

Descriptors: *Sludge disposal, *Drying, *Solid wastes, Suspended solids, *Solar distillation, *Waste treatment, Wastes, Sludge treatment, Disposal, Environmental sanitation, Engineering, Engineering structures, Design criteria, Evaluation, Research and Development, Water pollution control, Water pollution, Water purification, Water quality control, Georgia, Efficiencies, Performance.

An increased efficiency was verified experimentally for the drying of anaerobically-digested waste water sludge on a sand bed, using a simple shed roof of translucent corrugated fiberglass. A closed cover designed in the manner of a solar collector and featuring forced ventilation was constructed of light weight materials, and observed for several months prior to destruction by an unprecedented fall of pellet snow. Drying of sludge on suspended screens was shown to be very rapid. Enlargement of this study could provide for fabrication of more substantial covers, each placed on a separate drying bed. The solar-distiller type cover remains the most likely to provide a much-needed efficiency increase in drying beds for waste water sludges. It is possible that a screen arranged as a wide conveyor belt might be periodically loaded at one end and unloaded at the other. If the drying was enhanced by a solar cover or otherwise, a rate as much as four times normal might be achieved, based on the premise of rate-doubling due to enhancement plus exposure of twice as much sludge surface. Further study was recommended to fully evaluate the potential of solar-collector type covers for sludge drying beds. (Zielinski-IPA)
W81-00682

RAPID ASSAYS FOR MICROBIAL DEGRADATION OF 2-CHLOROPHENOL,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemical Engineering.
H. S. Pal, T. Murphy, A. C. Carter, and S. W. Drew.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-137929, Price codes: A03 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University, Bulletin 128, November, 1980. 31 p, 1 Fig, 5 Tab, 16 Ref. OWRT-B-088-VA(1).

Descriptors: *Chlorinated hydrocarbon pesticides, *Phenols, *Analytical techniques, *Microbial degradation, *Activated sludge, Halogenated pesticides, Organic compounds, Aromatic compounds, Chemical wastes, Chemicals, Industrial wastes, Water pollution, Water pollution sources, Gas chromatography, Cultures, Creosote, Waste treatment, Treatment facilities, Bactericides, Waste water(Pollution).

Standard agar and liquid culture techniques for evaluation of pure/mixed microbial cultures could be modified for estimations of microorganism resistance to and degradation of 2-chlorophenol (2-CP). The modified techniques should be useful in predicting the ability of waste treatment facilities to handle pulsed loads of 2-CP, and may be extended to other toxic compounds. Microorganisms for this study were from activated sludge from the Roanoke, Virginia, sewage treatment plant, and from a soil sample from an area used for creosote-coated lumber storage. The most powerful assay was a modified most-probable-number indicator assay, which allowed correlation of 2-CP resistant and 2-CP degrading subpopulations of a culture by differential reading at 18 and 36 hours. This assay confirmed the expected changed in microbial subpopulations that occur during acclimation of cultures to 2-CP. Determinations of 2-CP and phenol were made by gas chromatographic analysis and a distillation aminoantipyrine condensation-oxidation colorimetric method. The culture assay techniques were used to study shifts in microbial subpopulations identified as sensitive or resistant to the toxic effects of 2-CP. Increased resistance to 2-CP paralleled the increased 2-CP degrading capability of the subpopulations. Rapid and accurate estimation of 2-CP resistance/degradation was possible. (Zielinski-IPA)
W81-00697

FEASIBILITY OF PURIFICATION AND CONCENTRATION OF SELECTED WASTEWATER STREAMS BY ULTRAFILTRATION,
Mississippi State Univ., Mississippi State. Dept. of Chemical Engineering.
G. R. Lightsey, and N. Espinoza.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142267, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University Completion Report, October 1980. 31 p, 13 Fig, 7 Tab, 16 Ref. OWRT-A-130-MISS(1), 14-34-0001-0126.

Descriptors: *Filtration, *Water purification, *Waste water treatment, *Membranes, *Industrial wastes, Equipment, Water clarification, Water pollution treatment, Water quality control, Water treatment, Filters, Water quality, Research and development, Wastes, Organic matter, Suspended solids, Chemical oxygen demand, Laboratory tests, Facilities, Feasibility, Project planning.

A laboratory scale study was conducted to determine the feasibility of using ultrafiltration (UF) to purify waste water streams and concentrate the waste contents, for ultimate application to waste water streams such as in pulp/paper mills, hardboard plants, and cheese whey processing plants. Such industries place heavy loads on waste water treatment facilities due to the often significant amounts of high molecular weight organic matter in their waste waters. A batch-type UF process was used to concentrate cheese whey (CW), prehydrolysate (PH), and wood sugars (WS); producing protein, lactose and carbohydrate byproducts while reducing the effluent COD. The system used a commercial batch UF system equipped with Diaflow membranes and having a 2-liter capacity. The CW, PH, and WS were concentrated from 69, 47, and 21 grams/liter to 93, 71, and 60 grams/liter of solids, respectively. During the concentration run, 82, 68, and 88% by volume of the starting feed were recovered in the permeate. The COD reduction of CW, PH, and WS permeates ranged from 92-97% of initial values. Initial COD values of 60,000, 130,000, and 119,000 ppm were reduced to less than 2,000, 6,000, and 9,000 ppm, respectively. Thus, UF determined as an effective process for purification and for organic waste concentration of such waste water streams. (Zielinski-IPA)
W81-00701

SEVENTH ANNUAL REPORT: GREAT LAKES WATER QUALITY.
International Joint Commission, United States and Canada, Windsor (Ontario).
October, 1980. 101 p, 2 Fig, 5 Tab, 3 Append.

Descriptors: *Great Lakes, *Water quality, *International commissions, *Canada, *United States, North America, Bodies of water, Lakes, Great Lakes region, Waste disposal, Waste water(Pollution), Waste treatment, Treatment facilities, Legal aspects, Municipal wastes, Effluents, Industrial wastes, Pollutants, Toxins, Water pollution, Radio-active wastes, Water quality control.

This report marked the transition between the United States/Canada International Joint Commission's activities under the 1972 Great Lakes Water Quality Agreement (GLWQA) and those under the 1978 agreement, and presented an overview and lake-by-lake description of water quality in the Great Lakes Basin during 1978. Problems that arose from industrial/municipal wastes included toxic/hazardous substances and wastes disposal, phosphorous and eutrophication, long-range transport of air-borne pollutants and radioactivity. Topics of Great Lakes surveillance, Commission institutions and new directions under the 1978 Agreement were also covered. The Commission recommended that governments provide a complete inventory of all point source dischargers in the Basin; that improved municipal waste treatment plant efficiency be sought by using optimum operating/maintenance procedures and by upgrading operator skills; that priority be given to complete programs for abatement and control of dischargers of municipal waste waters to the Great Lakes System; and that all jurisdictions use the General and Specific Objectives of the 1978 GLWQA as minimum requirements in granting discharge permits or similar approvals. Governmental sponsoring of an experimental mapping project as also recommended to identify problems/benefits associated with environmental mapping. (Zielinski-IPA)
W81-00702

METHOD FOR BREAKING AN OIL-IN-WATER EMULSION,
Ford Motor Co., Dearborn, MI. (Assignee).
M. H. Weintraub, M. A. Dzieciuch, and R. L. Gealer.
U.S. Patent No 4,194,972, 5 p, 4 Fig, 13 Ref; Official Gazette of the United States Patent Office, Vol 992, No 4, p 1380, March 25, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Oil pollution, Oily water, Emulsions, Separation techniques, Electrolysis, Oxidation, Foam separation.

A method is disclosed for breaking an oil-in-water emulsion. The method includes the following general steps. A porous ferrous ion producing anode is established. A supply of the oil-in-water emulsion is located on one side of the anode and a fixed volume of the emulsion is flowed through a fixed cross sectional area of the anode per unit of time. Less than a passivating current is flowed through each unit area of the anode per unit of time thereby dissolving into the emulsion ferrous ion in sufficient quantity to break the emulsion. This results in a homogeneous dispersion of the ferrous ions in the fixed volume of the emulsion. There is an in situ generation of hydroxyl ion at the cathode and tiny air bubbles are introduced near the electrodes to oxidize the ferrous ions to ferric ions. The ferric ions are then permitted time to break the emulsion and remove the oil. This oil floats to the top surface in a froth and is removed. (Sinha - OEIS)
W81-00711

METHOD OF LOWERING THE COLOR OF EFFLUENT WHICH CONTAINS ARYL AZO- OR ARLY NITRO-CONTAINING COMPOUNDS,
American Color and Chemical Corp., Charlotte, NC. (Assignee).
R. E. Smith.
U.S. Patent No 4,194,973, 5 p, 12 Ref; Official Gazette of the United States Patent Office, Vol 992, No 4, p 1380, March 25, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Color, Industrial wastes, Chemical reactions, Separation techniques, Metals, Bactericides.

Effluent which contains aryl azo- and/or aryl nitro-containing compounds is treated to remove the color by contacting the effluent with Fe(II) in the presence of iron at a temperature and for a time sufficient to cause reduction of the aryl azo and aryl nitro groups of the effluent. Effluent containing metallized compounds may be treated in the same manner and then subjected to alkaline neutralization to remove the metal from the effluent. (Sinha -OEIS)
W81-00712

KRAFT PULP BLEACHING AND RECOVERY PROCESS,
Scott Paper Co., Philadelphia, PA. (Assignee).
R. P. Singh.
U.S. Patent No 4,196,043, 4 p, 12 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 233, April 1, 1980.

Descriptors: *Patents, *Waste water treatment, Water pollution, Industrial wastes, Bleaching wastes, Pulp and paper industry, Recirculated water, Water reuse, Water utilization, Chemical recovery.

In this invention Kraft pulp is bleached to a high brightness by a bleaching sequence comprising from one to about three treatments with ozone, and a final treatment with an alkaline peroxide solution, the bleach treatments being separated by an alkaline extraction. The effluent from each of the bleach treatments is collected and either, recycled and utilized in subsequent bleaching operations thereby reducing the amount of fresh water required, or introduced into the chemical recovery system of a Kraft pulping process thereby eliminating pollution which would otherwise be caused by dumping these effluents. (Sinha - OEIS)
W81-00718

SEWAGE TREATMENT,
BOC Ltd., London (England). (Assignee).
M. E. Garrett, and K. C. Smith.
U.S. Patent No 4,196,074, 4 p, 2 Fig, 2 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 241, April 1, 1980.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Oxygenation, Sewers, Water pollution treatment, Equipment.

In order to reduce the likelihood of the formation of hydrogen sulphide in the sewer and to reduce the amount of further treatment required to be carried out on sewage, oxygen containing gas is dissolved in sewage passing to, or through, a sewer during periods of pumping. A stream of the sewage is withdrawn during periods when sewage is being held in the sewer. This stream is passed through a conduit so as to promote dissolution of oxygen-containing gas introduced into, or entrained in, the stream. The stream is then returned to the sewer. By this means a chosen concentration of dissolved oxygen may be maintained in the volume of sewage between the points of withdrawal and return of the stream. (Sinha - OEIS)
W81-00719

PROCESS AND APPARATUS FOR DEWATERING GRANULATED MATERIAL, ESPECIALLY GRANULATED BLAST FURNACE SLAG,
For primary bibliographic entry see Field 3E.
W81-00720

PLEATED FILTER UNDERDRAIN, METHOD AND APPARATUS,
Harsco Corp., Wormleysburg, Pa. (Assignee).
For primary bibliographic entry see Field 5G.
W81-00721

COMBINATION OF A BIOLOGICAL DRY TOILET AND A BIOLOGICAL WASTE WATER PURIFYING PLANT,
Asko-Upo Oy, Lahti (Finland). (Assignee); and AGA Heating A. B., Geoteborg (Sweden). (Assignee).
T. T. Salokangas, U. T. Lammi, and T. J. Miettinen.
U.S. Patent No 4,196,082, 4 p, 1 Fig, 9 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 244, April 1, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Biological treatment, Domestic wastes, Soil disposal fields, Filtration, Equipment, Dry toilets.

In a combination of a biological dry toilet and a biological waste water purifying plant the heat and coarse sludge of the so called grey water from households is recovered in the dry toilet to which also the fine sludge from the waste water purifying plant is pumped. The heat obtained is used for heating the compost and both sludges collected in the filters are from time to time combined to compost them together with the other waste in the dry toilet. A suction fan in the dry toilet also sucks the air needed by the biofilter through the filter bed. The purified water obtained from the waste water purifying plant is absorbed in the soil. (Sinha-OEIS)
W81-00723

THE EFFECT OF DISSOLVED OXYGEN CONCENTRATION ON NITRIFICATION,
California Univ., Los Angeles. School of Engineering and Applied Science.
M. K. Stenstrom, and R. A. Poduska.
Water Research, Vol 14, No 6, p 643-649, June, 1980. 3 Fig, 1 Tab, 50 Ref.

Descriptors: *Dissolved oxygen, *Nitrification, *Kinetics, *Reviews, *Biological treatment, Aquatic bacteria, Waste water treatment, Sewage bacteria, Sewage treatment, Activated sludge, Retention, Laboratory tests, Diffusion, Flocculation, Theoretical analysis, Variability, Natural streams, Aeration, Rates.

A review of the literature on the effects of dissolved oxygen (D0) levels on the rate of nitrification is presented, and the mechanisms which could be responsible for the variability in the reported findings are evaluated. Research has been conducted in both pure and mixed cultures and in cultures isolated from wastewater treatment systems. Data from all sources indicate that the maximum growth rates of nitrification reactions are affected by D0 levels over the range of 0.3 milligrams/liter to as much as 4.0 milligrams/liter. Conflicting results arise from studies revealing D0 levels of 4.0 milligrams/liter for maximum nitrification rates, while other experiments show achievement of maximum nitrification rates at only 0.5 to 1.0 milligram/liter of D0. These variations in results have been attributed to the effects of oxygen diffusion in flocs, differences in measure results due to steady-state and dynamic measuring methods, and epecially double-substrate limited kinetics. (Geiger-FRC)
W81-00729

A COMPARISON OF MODELS FOR COMPLETELY MIXED ACTIVATED SLUDGE TREATMENT DESIGN AND OPERATION,
Centre Belge d'Etude et de Documentation des Eaux, Liege.
L. Vandevenne, and W. W. Eckenfelder, Jr.
Water Research, Vol 14, No 6, p 561-566, June, 1980. 6 Fig, 25 Ref.

Descriptors: *Activated sludge, *Sludge treatment, *Design, *Mathematical models, *Essential nutrients, Organic matter, Wastes, Suspended solids, Physical properties.

Two models for completely mixed activated sludge treatment design and operation are compared. With the exception of the varible for influent substrate concentration, they are similar in concept. Both the McKinney, Eckenfelder model and the Lawrence, McCarty model incorporate substrate removal, effect of initial substrate concentration, and nutrient requirements. A statistical analysis of performance data for both models showed a slightly better correlation coefficient for the Eckenfelder model, which includes the variable for influent substrate concentration. This variable is significant in determining the retention time necessary to achieve removal of biochemical oxygen demand and to maintain food/microorganism ratios. It may affect design considerations for industrial wastewater treatment facilities. However, more research is necessary to determine the significance of influent substrate concentration on the removal rate in most activatd sludge processes. (Titus-FRC)
W81-00730

CONCENTRATION OF IMPURITIES BY PROGRESSIVE FREEZING,
Chalmers Univ. of Technology, Geoteborg (Sweden). Dept. of Chemical Engineering Design.
R. Halde.
Water Research, Vol 14, No 6, p 575-580, June, 1980. 9 Fig, 10 Ref.

Descriptors: *Water purification, *Solutes, *Ice, Freeze-thaw tests, Crystallization, Laboratory tests, Ice-water interfaces, Wastes, Suspended load, Temperature, Desalination processes, Sludge treatment.

The method of purifying water by freezing is discussed. It is based on the fact that ice crystals built up from aqueous solutions are composed of pure water, while impurities remain in liquid state. Thus, it has application for concentating wastes and for desalination. Experimentation with freezing rate, applied shear forces and added chemicals reveals that each affects impurity migration. Intense stirring of the liquid phase provides for higher degrees of purification. Purfication is slightly increased by increased rate of freezing. Particles greater than .000005 m in size are more easily separated. In application to sludge, it was found that raw and dewatered sludge can produce an impurity concentration less than .03%, while thickened, digested sludge diluted with pure water rendered the best separation, due to reduced particle size. The addition of a polymer to the liquid phase improved migration during freezing. (Titus-FRC)
W81-00731

CHARACTERISTIC EVALUATION OF TRICKLING FILTER PROCESS,
Tokyo Inst. of Tech. (Japan). Research Lab. of Resources Utilization.
Y. Hosono, H. Kubota, and Y. Miyaji.
Water Research, Vol 14, No 6, p 581-590, June, 1980. 16 Fig, 4 Tab, 23 Ref.

Descriptors: *Trickling filters, *Waste water treatment, *Numerical analysis, Filters, Flow rates, Biochemical oxygen demand, Equipment, Water quality control, Equations, Temperature, Microorganisms, Hydraulics.

A method is proposed for prediction of the biochemical oxygen demand removed from wastewater in the trickling filter process. The method involves calculations dependent on type of media, surface area of the filter bed, superficial liquid flow rate and influent biochemical oxygen demand. Operating conditions of both standard and high-rate trickling filters for wastewater were experimentally determined. Results indicate that higher fractions of biochemical oxygen demand removal are obtained with increased liquid recycle ratios. Power economy, defined as removal rate per unit power consumption, decreases significantly with increased loading of the filter. Standard trickling filters with a liquid recycling ratio of 0 give higher power economy values at lower loadings, while high-rate filters with a higher ratio are advantageous at higher loadings. The absolute values of power economy are relatively low in

comparison with the activated sludge process. (Titus-FRC)
W81-00732

BIODEGRADABILITY DETERMINATIONS IN TRICKLING FILTER UNITS COMPARED WITH THE OECD CONFIRMATORY TEST,
Henkel KGaA, Duesseldorf (Germany, F. R.). Dept. of Ecology.
P. Gerike, W. K. Fischer, and W. Holtmann.
Water Research, Vol 14, No 7, p 753-758, July 1980. 1 Fig, 1 Tab, 7 Ref.

Descriptors: *Analytical techniques, *Biodegradation, *Trickling filters, *Testing procedures, Mathematical studies, Carbon, Activated sludge, *Sewage treatment, Laboratory tests, Settling basins, Sewage bacteria, Biological treatment.

The sensitivity, reproducibility, and tolerance limits as well as the advantages and problems of the coupled units test, a modified version of the OECD Confirmatory Test, were examined. The method has been applied to trickling filters with square wave feeding tests and a new transinoculation procedure. Reproducibility of the method for determining the biodegradability of environmental chemicals is generally good. The COD and DOC removals for various compounds in the coupled units test were investigated. Tolerance limits width was found to be dependent upon the number of determinations and the test concentration. Due to the success of transinoculation in the trickling filters accomplished by the simple exchange of effluents from the test and parallel units, the same procedure was tried in the conventional coupled units test in the OECD Confirmatory Test by exchanging liquid out of the settling tank rather than out of the activated sludge vessel. The advantage of this step was that no material adsorbed on the sludge could be transferred from the test unit to the parallel unit in the transinoculation procedure. The two major contributors to the tolerance limits were analytical and biological variance. Mathematical studies offered clues for improving the method. (Geiger-FRC)
W81-00735

ON FARM AEROBIC TREATMENT OF PIGGERY WASTE. THE EFFECT OF RESIDENCE TIME AND STORAGE ON EFFLUENT QUALITY,
North of Scotland Coll. of Agriculture, Aberdeen (Scotland).
D. R. Fenlon, and P. J. Mills.
Water Research, Vol 14, No 7, p 805-808, July, 1980. 4 Tab, 14 Ref.

Descriptors: *Farm wastes, *Aerobic treatment, *Livestock, *Organic wastes, Effluents, Water quality, Chemical oxidation demand, Waste disposal, Feedlots, Denitrification, Suspended solids, Farm lagoons.

A description of the effect of reducing the residence time of screened pig slurry in a pilot scale oxidation ditch is presented. The soluble organic fraction was significantly reduced by conversion to suspended solids and organic nitrogen at reduced residence times and by mineralization at long residence times. Desorption and denitrification caused high losses of inorganic nitrogen during the treatment process. A laboratory system using the same waste at a controlled loading rate demonstrated that the amount of oxygen demand lost per day was constant, and confirmed that the residence time determined whether mineralization or solids production occurred. Over-winter storage of aerobically treated waste resulted in a small increase in soluble COD; however, it remained far more acceptable for land disposal than untreated material. (McKeon-FRC)
W81-00738

EFFLUENT TREATMENT AND ALGAE RECOVERY BY OZONE-INDUCED FLOTATION,
Israel Inst. of Tech., Haifa. Environmental and Water Resources Engineering.
N. Betzer, Y. Argaman, and Y. Kott.
Water Research, Vol 14, No 8, p 1003-1009, August, 1980. 7 Fig, 4 Tab, 14 Ref.

Descriptors: *Ozone, *Oxidation lagoons, *Flotation, *Water purification, *Algae, Waste water treatment, Coliforms, Separation techniques, Foaming, Frothing, Sewage treatment, Suspended solids.

In studies concerned with disinfection of stabilization ponds effluents, algal separation by ozone-induced flotation was observed. In the present study, the practical application of this phenomena was investigated on a bench-scale flotation column using oxygen enriched with ozone. A clear colorless liquid resulted from the process with over 98% removal of suspended solids. Fecal coliforms were reduced up to three orders of magnitude by the process. Usual ozone dosages required ranged from 15 to 50 mg/liter. The froth that resulted thickened to form a pure algal mass composed of 8.5% solids. The reaction of ozone with algal cells was shown to form a hydrophobic surface which could be separated by bubbling. The thickened algal froth formed a valuable product. Liquid effluents could then be disinfected without formation of hazardous chlorinated organics. The process offers an attractive approach to waste-water treatment under certain circumstances. (Geiger-FRC)
W81-00744

EVALUATION OF OZONE INDUCED BIODEGRADABILITY OF WASTEWATER TREATMENT PLANT EFFLUENT,
Technion - Israel Inst. of Tech., Haifa. Environmental and Water Resources Engineering.
N. Narkis, and M. Schneider-Rotel.
Water Research, Vol 14, No 8, p 929-939, August, 1980. 13 Fig, 3 Tab, 12 Ref.

Descriptors: *Biodegradation, *Ozone, *Sewage effluents, Biological treatment, *Waste water treatment, Lime, Sewage bacteria, Organic wastes, Oxidation, Costs, Pilot plants, Hydrogen ion concentration.

A method was tested for the quantitative determination of biodegradability induced by ozone on refractory organic matter in solution after conventional treatment of wastewater by biological methods and by lime. The long-term BOD test is suitable for aqueous solutions with relatively low levels of organic matter. Seeding of water samples with bacteria was accomplished with filtered effluent of biological treatment plants. COD, total organic carbon, BOD, and dissolved oxygen were measured, as well as nitrification, pH, and changes in bacterial populations. An improvement in biodegradability was found in ozonated samples and was attributed to the removal of inhibitory effects due to changes in molecular structure. Acclimation of ozonated effluents was required in all biodegradability tests. A combination of lime treatment and high pH (11.8) enhanced biodegradability, an effect which was not observed with lime treatment alone. It was suggested that the ozone levels used in these pilot studies were too high to be cost efficient, although they were more than adequate for increasing the level of biodegradability in wastewater effluents. (Geiger-FRC)
W81-00746

5E. Ultimate Disposal Of Wastes

THE SURVIVAL OF SALMONELLAE IN SEWAGE SLUDGE APPLIED TO ARABLE LAND,
North West Water Authority, Warrington (England). Western Div.
D. C. Watson.
Water Pollution Control, Vol 79, No 1, 11-18, 1980. 3 Fig, 3 Tab, 16 Ref.

Descriptors: *Arable land, *Salmonella, *Sewage sludge, Sewage disposal, Ultimate disposal, Spraying, Soil types, Sands, Organic soils, Organic wastes, Sludge digestion, Sludge disposal, Air temperature, Domestic wastes.

The survival of salmonella in sewage sludge applied to arable land in England was investigated. Sludge was mainly of domestic sewage origin and underwent mesophilic digestion which removed 85-95% of salmonella. The digested sludge, containing about 64% organic wastes, was applied at 70 cu m/ha by spraying. Samples of soil and sludge were taken on application, and soil/sludge samples were taken weekly for 10 wk thereafter. The experiment was conducted in April-July 1976 (a hot, dry period) on sandy soil and in May-July 1977 (typical climate) on a similar soil and on a heavier soil containing more organic matter. On application, the sludge contained 300 and 250 salmonella/kg on wet weight in 1976 and 1977, respectively. Numbers of salmonella/kg in the soil/sludge ranged from 0 (wk 7, 8 and 9) to 160 (1 wk) in 1976 and from 0 (wks 6, 8, and 9) to 35 (wk 1) in 1977. Factors affecting salmonella survival in the environment are its physical state, availability of organic matter, environmental temperature (greater survival at 1-5C than at 10-15C), moisture content of surrounding material (they are susceptible to desiccation), pH of soil, rainfall, and sunshine. The logarithmic die-off of the organisms (T90) was similar for both years for the sandy soil (3.6), though that for the heavier soil was 3.0. It is postulated that the variation in T90 between soils was due to numbers originally present or to the nature of the soil. The survival period of salmonella was about 6 wk, but this is dependent on the numbers originally present in sludge and on environmental conditions. (Just-FRC)
W81-00572

WANT NOT, WASTE NOT. SENSIBLE SLUDGE RECYCLING,
Department of the Environment, London (England). Water Engineering.
R. Best.
Water Pollution Control, Vol 79, No 2, p 307-321, 1980. 9 Fig, 1 Append.

Descriptors: *Sludge disposal, *Sewage sludge, *Recycling, *Environmental effects, Cost-benefit analysis, Public health, Waste water treatment, Environmental sanitation, Nutrients, Heavy metals, Incineration, Land management, Organic wastes, Microorganisms, Sludge treatment.

The Chairman of the Department of the Environment's (U.K.) Standing Committee on the Disposal of Sewage Sluge offers his personal approach to sludge disposal in the waste water cleaning process. The safe, effective and economic disposal of sewage sludge is one of the most challenging aspects of waste water disposal. Knowledge of the characteristics of sewage sludge is essential in understanding its handling and disposal. Sludge may contain particulate matter, free water (about 70%), capillary water (2%), floc water (20%) and intracellular water (8%) by some definitions, although the characteristics of a sludge may vary considerably. Objectives for sludge disposal must be clearly defined, and acceptable residual risks must also be taken into account, and recycling of sludge material must be a priority. Substances targeted for reuse or recovery from sludge material include organic matter, nutrients, trace substances, heavy metals, graded mineral particles, and pathogens. Unrecoverable material is usually returned to land via spreading from tankers or spraying from pipes or is discharged to water bodies. Harmful sludge is usually incinerated. New attitudes towards sludge reuse in the future may require reeducation. A discussion follows the article. (Geiger-FRC)
W81-00585

THE DEWATERING OF ACTIVATED SLUDGE: MEASUREMENT OF SPECIFIC RESISTANCE TO FILTRATION AND CAPILLARY SUCTION TIME,
Commonwealth Scientific and Industrial Research Organization, Rockhampton (Australia). Meat Research Lab.
B. V. Kavanagh.
Water Pollution Control, Vol 79, No 3, p 388-398, 1980. 7 Fig, 17 Ref.

Descriptors: *Dewatering, *Activated sludge, *Flow resistance, *Filtration, Waste treatment, Sludge, Regression analysis, Hydraulics, Mathematical models, Sludge treatment, Resistance, Capillary action.

The results of an experimental study aimed at critically assessing the validity of the basic filtration equation developed by Carman in describing the filtration of activatd sludges are presented. The study indicated that with the exception off the role of pressure, the basic filtration equation can be used quanitatively to describe the filtration of biological sludges. The measurement of specific resistance to filtration (SRF) represents the best defined laboratory measurement of sludge dewaterablity currently available. This and other studies also indicated that capillary suction time (CST) measurements are a useful measure of sludge filterability and can be directly related to SRF measurements. The functional dependence of CST measurements on variables such as solids concentration and viscosity is consistent with that expected on the basis of theoretical considerations. It is suggested that an operating pressure of 49.1 kPa (368 mm Hg) be made the standard value for use in the determination of the SRF of biological sludges. (McKeon-FRC)
W81-00613

DISPOSAL OF SEWAGE SLUDGE TO LAND: CHEMICAL AND MICROBIOLOGICAL ASPECT OF SLUDGE TO LAND POLICY,
Yorkshire Water Authority (England). Office of Scientific Services.
J. A. Hudson, and H. Fennel.
Water Pollution Control, Vol 79, No 3, p 370-387, 1980. 33 Ref.

Descriptors: *Sludge disposal, *Land management, *Toxins, *Soil contamination, *Public health, Sewage sludge, Sludge treatment, Nutrients, Cultivation, Heavy metals, Incineration, Pesticide residues, Fertilizers, Organic matter, Lead, Industrial wastes, Animal parasites, Microorganisms, Zinc, Cadmium, Recycling.

The spreading of sewage sludge on farm land poses the problems of adding toxic metals to the soil and spreading organisms that are pathogenic in man and animals. Toxic metals may find their way into farmland soil not only from sewage sludge deposition but from other industrial effluents, by fertilizers, ameliorants, pesticides, or by motor exhaust fumes, pig slurry, or composted refuse. Sampling of farmland soils for analyses for heavy metals was conducted by the Soil Science Laboratories at Leeds, England. Of 210 fields sampled, 16 were considered to be contaminated with zinc (> 250 mg/kg), but it was not certain this was due to sludge disposal. Analyses for cadmium and lead in the Leeds area showed that neither metal was present in quantities that would be toxic according to current standards. Studies have shown that factors such as soil properties, plant species and cultivation practices may influence the amount of metals available to the soil from sewage sludges. Sludges from the Yorkshire area containing toxic levels of heavy metals are incinerated. Addition of sludge to farmland may be beneficial if the sludge contains sufficient nutrients to replace the use of organic fertilizers. Methods are presented for calculating safe field application rates for zinc from sludge to farmlands. An evaluation of the kinetics of microorganisms and beef and pork tapeworm from sewage sludge to farmlands to man and animals is presented. What happens to these organisms during sewage treatment and during sludge application to land is described along with their movement by water courses and underground water sources. A discussion follows the article. (Geiger-FRC)
W81-00615

METHODS FOR THE ISOLATION OF VIRUS FROM RAW AND DIGESTED WASTEWATER SLUDGE,
Royal Veterinary and Agricultural Univ., Copenhagen (Denmark). Dept. of Veterinary Virology and Immunology.
For primary bibliographic entry see Field 5G.
W81-00632

RVRFLO: A HYDRAULIC SIMULATOR OF WATER QUALITY IN THE HOUSATONIC RIVER IN CONNECTICUT,
Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 5B.
W81-00651

METHOD FOR STORING WASTE MATERIALS AND THEIR COMBUSTION RESIDUES IN A MANNER HARMLESS TO UNDERGROUND WATER,
H. Egger.
U.S. Patent No 4,194,855, 5 p, 1 Fig, 6 Ref; Official Gazette of the United States Patent Office, Vol 992, No 4, p 1341-1342, March 25, 1980.

Descriptors: *Patents, *Waste storage, *Waste disposal, Underground waste disposal, Subsurface waters, Linings, Sealants, Industrial wastes.

An earth pit is prepared for the storage of waste materials by lining the bottom of the pit with a layer of finely-ground loose material followed by a synthetic plastic sheet resistant to humas, roots and tearing followed by a second layer of finely-ground loose material. The layers of loose material equalize the pressure on the opposite sides of the synthetic plastic sheet. A number of sheets may be solution-welded together for a large pit. A further important property which the sheet should possess is chemical resistance, in particular, resistance to alkali. Particularly suitable for the purposes of the invention are suitably stabilized PVC sheets, in particular, those stabilized with barium/cadmium compounds. (Sinha-OEIS)
W81-00710

5F. Water Treatment and Quality Alteration

DIRECT FILTRATION OF VIRGINIA SURFACE WATERS: FEASIBILITY AND COSTS,
West Virginia Inst. of Tech., Montgomery. Dept. of Civil Engineering.
R. F. McCormick, and P. H. King.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127391, Price codes: A06 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg, Bulletin 129, November 1980. 99 p, 21 Fig, 26 Tab, 40 Ref. OWRT A-081-VA(1).

Descriptors: *Virginia, *Surface waters, *Water supply, *Water treatment, *Filtration, Economics, Feasibility studies, Costs, Filters, Design(Filters).

This research investigated the technical and economic feasibility of the direct filtration technique for treating high-quality Virginia surface waters prior to domestic use. One of the flow schemes that was investigated eliminates the sedimentation basin while employing a full, conventional flocculation period. Another eliminates separate sedimentation and flocculation units altogether. Major variables that were assessed in terms of their effects on direct filtration performances included raw water characteristics such as turbidity, color, total dissolved solids, total hardness, algae count, and total coliform count; filter design variables such as type and size of media (two dual media filters and one trimedia were evaluated); and operating variables such as hydraulic loading rate and nature and dosage of applied coagulant. The most effective filtration scheme consisted of a three minute rapid mix with alum and cationic polymer as primary coagulants, followed by filtration at a 5 gallons per minute/sq ft loading rate through 20 inches of 1.3-mm effective size anthracite coal and 10 inches of 0.45-mm effective size silica sand. Color and algae concentrations had definite effects upon the direct filtration process. Results from the study show that raw waters with turbidities less than 10 NTU, color less than 15 APHA units, and algae concentrations less than about 1,000 colonies/ml should be excellent candidates for economical treatment by direct filtration.
W81-00501

FLUSHING SYSTEM FOR REVERSE OSMOSIS WATER PURIFICATION UNITS,
W. A. Parkinson.
U.S. Patent No 4,193,872, 5 p, 2 Fig, 4 Ref; Official Gazette of the United States Patent Office, Vol 992, No 3, p 1004, March 18, 1980.

Descriptors: *Patents, *Water treatment, *Water purification, Separation techniques, *Reverse osmosis, Domestic water, Membranes, Flushing.

A reverse osmosis water purification system for home usage is flushed periodically automatically by actuation of a non-related apparatus. In one embodiment, the reverse osmosis cartridge is mounted directly in the cold water line to a sink, so that water passes through the cold water inlet through the contaminated water outlet to the cold water faucet to the sink, flushing contaminants out of the cartridge through the faucet when the faucet is opened. In another embodiment, flushing is actuated by a solenoid-operated valve electrically connected to a garbage disposal switch. (Sinha - OEIS)
W81-00525

THE EFFECTS OF PERMANGANATE PRETREATMENT ON TRIHALOMETHANE FORMATION IN DRINKING WATER,
North Carolina Univ. at Chapel Hill.
P. C. Singer, J. H. Borchardt, and J. M. Colthurst.
Journal of the American Water Works Association, Vol 72, No 10, p 573-578, October, 1980. 11 Fig, 8 Ref.

Descriptors: *Chlorination, *Water treatment, *Organic compounds, Disinfection, Surface waters, Halogens, Potable water, Oxidation, Water pollution, Permanganate.

The effects of permanganate pretreatment on trihalomethane formation in drinking water were examined in water samples collected from the surface waters of Chapel Hill and Durham, North Carolina. Samples were treated with permanganate with a controlled quenching procedure to minimize the addition of excess sulfite. Quenched samples were filtered to remove manganese dioxide and then were stored until chlorination. Chlorine was added at pH 7 and sample bottles were sealed. Aliquots were sampled from each bottle and titrated amperometrically with PAO to determine the residual free chlorine concentration. Permanganate had a relatively minor effect on the subsequent chlorine demand of the water. Permanganate reactivity in the water was found to be a function of raw water quality, pH and permangante dose. The chloroform formation potential of water samples was decreased by permanganate treatment in a manner which was proportional to the amount of permangante consumed after the immediate oxidant demand of the water was met. Permanganate had little effect on chloroform production when used at the doses typically employed for water pretreatment. Larger doses would be required to reduce the formation of trihalomethanes in practice. When permanganate is used for oxidative pretreatment purposes, chlorine may be added as a post-treatment procedure after filtration so that chlorine is added to a cleaner water with fewer precursorsof trihalomethane. (Geiger-FRC)
W81-00570

DRINKING WATER CHLORINATION: A PRACTICE UNRELATED TO CANCER MORTALITY,
Massachusetts Univ., Amherst. Dept. of Environmental Health.
R. W. Tuthill, and G. S. Moore.
Journal of the American Water Works Association, Vol 72, No 10, p 570-573, October, 1980. 1 Fig, 2 Tab, 27 Ref.

Descriptors: *Potable water, *Chlorination, *Cancer, Human diseases, Public health, Disinfection, Water purification, Toxicity, Epidemiology, Massachusetts, Social aspects.

The charge that chlorination of drinking water has been linked positively to increased incidence of cancer of the stomach and rectum has been reevaluated. Massachusetts communities having public water supplied from surface sources in 1949 whose

population growth did not exceed 25% between 1950-1970 were investigated. Measurements were made of the average chlorine dose used in the past, recent trihalomethane levels in the water, and recent doses of chlorine. Cancer mortality data from 1969 to 1976 was used. U.S. census records supplied sociodemographic information for each community, including median family income, educational level, percent of nonwhite and foreign-born residents, and percent population change. The data indicated that the initially significant correlations between the levels of trihalomethanes in drinking water and incidence of colon or rectal cancer disappeared after controlling for ethnicity in the first case and foreign-born residents in the latter case. It is suggested that studies linking stomach and rectal cancer to chlorination of drinking water may have been premature in that they did not include socioeconomic variables in their analyses. (Baker-FRC)
W81-00592

AN EMPIRICAL KINETIC MODEL OF TRIHALOMETHANE FORMATION: APPLICATIONS TO MEET THE PROPOSED THM STANDARD,
Montgomery (James M.), Inc., Pasadena, CA.
M. C. Kavanaugh, A. R. Trussell, J. Cromer, and R. R. Trussell.
Journal of the American Water Works Association, Vol 72, No 10, p 578-582, October, 1980. 11 Fig, 22 Ref.

Descriptors: *Potable water, *Chlorination, *Model studies, *Water pollution sources, *Organic compounds, Disinfection, Bromides, Surface waters, Ammonia, Nitrogen compounds, Water treatment, coagulation, Water purification, Organic loading, Standards, Chemical reactions.

When a chlorine is used for disinfection of drinking water, the approach to the reduction of trihalomethane (THM) production has been to reduce the potential for formation of THM prior to chlorination or to remove THM after formation. Due to the complexity of the reactions of chlorine with other organic molecules in water, few kinetic models of THM formation have been formulated. The present study presents a semiempirical reaction rate model for THM formation based on the overall reaction stoichiometry. THM formation is described by a single-rate expression, and an analytical framework for evaluating the THM formation potential in water is provided. The model, which is still in the developmental stage, is a two-parameter kinetic model that allows estimation of the acceptable effluent total organic content (TOC) that must be achieved. Coagulation or GAC adsorption are used when chlorine is applied as a postdisinfectant. Optimum coagulation and reduced chlorine dose will ensure that proposed standards of 100 micrograms/liter total THM are met in surface waters with TOC values of 3-4 milligrams/liter and low bromide levels. The dependence of the THM formation rate on the applied chlorine dose as well as the effect of bromide, ammonia and organic nitrogen indicate that a standard procedure for estimating THM formation potential in a water supply would be difficult to achieve. (Geiger-FRC)
W81-00596

REBUILDING LENGTHENS FILTER RUNS FOR ALGAE-PLAGUED UTILITY,
Gary-Hobart Water Corp., Gary, IN.
K. Young.
American City and County, Vol 95, No 6, p 40-41, June, 1980. 1 Fig.

Descriptors: *Filters, *Potable water, *Algae, Diatoms, Sands, Coals, Turbidity, Costs, Municipal water, Water purification, Water treatment.

Sand filters with a 2-3 gpm/sq ft filtration rate were designed to improve water quality in the Gary, Iniana drinking water supply system. However, filter runs soon dropped from 35-40 hr to as little as 3 hr during the summer's high filtration rates due to an abundance of algae, predominatly diatoms. As a solution to the problem, 6-inch caps of 0.85- to 0.90-mm anthracite were placed on four of the six filters. One filter was converted to a dual media bed of sand (6 inches) and anthracite (18 inches), while the sixth remained as a control sand filter. Four turbidimeters were installed to monitor the water and the filters. The performance of the dual media filter was equal to that of the capped filter, and the former was capable of storing greater quantities of tubidity at a low head loss. These two types of filter performed as well or better than the sand filter and allowed filter runs to double or triple. All filters were also checked for gravel mounding. Since that tie, the filters have been rebuilt to incorporate the dual media design at a rate of one a year. Filter runs now average 70-80 hr during summer high pumpage periods and the amount of wash water needed has been reduced. Costs have also been reduced. However, the deep anthracite bed and the polyelectrolyte addition requires a longer wash to break up the heavy floc and move it up and out of the filter. (Baker-FRC)
W81-00606

INDUSTRIAL SURCHARGES THAT INDUSTRY LIKES,
Burgess and Niple Ltd., Columbus, OH.
H. R. Stonerook, and R. E. Birkbeck.
American City and County, Vol 95, No 5, p 63-65, May, 1980. 2 Fig, 1 Tab.

Descriptors: *Municipal water, *Industrial wastes, *Water rates, Prices, Food processing industry, Water pollution sources, Waste water treatment, Monitoring, Costs, Biochemical oxygen demand, Sewage treatment, Inflow, Legislation.

Orrville, Ohio (population 7,850) has enacted an ambitious industrial monitoring program which allows fair distribution of the costs involved in treating polluted water. About 70% of the city's waste water treatment revenue comes from nondomestic users of the water supply. Orrville contains 23 major industrial plants and processes and sanitizes waste streams from all but one of these plants. Four of the plants are food processors, contributing 24% of the flow and 70% of the BOD to the city treatment facility. In June 1972, legislation was passed which required industries to establish flow monitoring and sampling stations within one year. When some industries did not comply, the city monitored their discharges and billed the companies for water usage accordingly. The waste water treatment plant demonstrates erratic flow behavior due to changes in industrial processes. Average peak-month BOD loads have exceeded 10,000 lb/day. Peak-day influent BOD loads regularly exceeded 10,000 lb/day and were observed to be as high as 19,114 lb/day. Flow equalization, which improves flexibiltiy, is achieved by regulating the amount of sewage pumped through the treatment plant and surcharging the influent trunk sewer. Food processing industries are assessed a surcharge of $0.1231/lb of contributed BOD and $0.0568/100 gal of process waste. (Baker-FRC)
W81-00607

IMPROVED METHOD GENERATES MORE CHLORINE DIOXIDE,
Penwalt Corp., Belleville, NJ. Wallace and Tiernan Div.
R. W. Jordon, A. J. Kosinski, and R. J. Baker.
Water and Sewage Works, Vol 127, No 10, p 44-45, October, 1980. 5 Fig, 9 Ref.

Descriptors: *Chlorination, *Water treatment, *Laboratory test, *Chemical reactions, Chlorine, Disinfection, Odor, Volumetric analysis, Spectrophotometry, Costs, Hydrogen ion concentration, Acidity.

The use of hydrochloric acid in the generation of chlorine dioxide as an alternative to chlorine for water disinfection is discussed. Chlorine dioxide is generated from sodium chlorite and chlorine. Tests have established that in small cost-effective doses (0.1 mole H(+) (HCl) per mole sodium chloride), hydrochloric acid produces a yield greater than 90% using no excess chlorine. Unreacted chlorine and unreacted sodium chlorite in the product stream are reduced, improving both yield and purity. With hydrochloric acid, the generating apparatus requires accurate metering, interlocks to prevent the combination of strong chemical solutions, and special consideration for backpressure at the point of application of the chlorinator injector. Laboratory tests were performed using three methods to check the experimental yields of chlorine dioxide. Titration and spectrophotometry produced good agreement at 360 nm. Purity could not be tested because chlorine and chlorite are mutual interferences in spectrophotometric analyses. Good agreement was also obtained at 260 nm between titration and operation of the apparatus without the chlorinator. Hydrochloric acid is in limited use in Europe and provides more economy for extensive use in taste-and-odor control and the oxidation of manganese. (Titus-FRC)
W81-00610

DESIGN OF BIOLOGICAL FILTRATION PLANTS,
Water Research Centre, Stevenage (England).
G. Hoyland, and N. J. Harwood.
Water Pollution Control, Vol 79, No 3, p 352-269, 1980. 12 Fig, 1 Tab, 19 Ref.

Descriptors: *Mathematical models, *Design, *Trickling filters, *Sewage treatment, *Biological treatment, Suspended solids, Biochemical oxygen demand, Optimization, Economics, Costs, Filtration, Capital costs, Operating costs, Settling basins.

Mathematical models were devised to optimize the capacities of primary sedimentation and biologcial filtration to minimize the overall cost of treatment. Optimization was carried out for two hypothetical works with single biological filtration serving populations. of 10,000 and 100,000, the average daily flow of sewage per person being 200 liters. Derivations are described in detail. The total costs of biological filtration works treating sewage to a 25 mg/liter suspended solids/15 mg/liter BOD standard were minimized to determine optimum design. Optimization was based on capital and operating costs and on performance relations derived from primary sedimentation and secondary treatment. The empirical performance relationships for primary sedimentation predict the average composition of settled sewage for overflow rates of 0.5-6.0 m/hr and influent suspended solids concentrations of 200-1,000 mg/liter. A comparison of total annual costs of filters with equal interfacial area showed that a small random plastic medium having an effective surface area of 200 sq. m/cu m may be more economical than a stone medium having an area of 100 sq m/cu m. The optimization suggested that the total cost of treatment was minimized at works where the retention period in primary sedimentation tanks was low, especially at the works where sludge-treatment costs were high. Discussions follow this paper.(McKeon-FRC)
W81-00616

FIELD EXPERIMENTS ON APPLICATION OF TREATED MUNICIPAL WASTE WATERS TO VEGETATED LANDS,
Tehran Univ. (Iran).
For primary bibliographic entry see Field 3C.
W81-00620

CHARACTERIZATION AND ACTIVATED CARBON ADSORPTION OF SEVERAL HUMIC SUBSTANCES,
Illinois Univ., Urbana-Champaign. Dept of Civil Engineering.
J. J. McCreary, and V. L. Snoeyink.
Water Research, Vol 14, No 2, p 151-160, February, 1980. 9 Fig, 5 Tab, 20 Ref.

Descriptors: *Humic acids, *Fulvic acids, *Activated carbon, *Adsorption, Chlorination, Water treatment, Organic compounds, Water purification, Laboratory tests, Physical properties, Separation techniques, Hydrogen ion concentration, Phosphates, Molecular structure, Organic acids, Soil physical properties.

The formation of trihalomethanes (THM) during chlorination in water treatment processes has been linked to humic acid in the water supply. Removal of THM may be accomplished after the chlorination step, or these compounds may be reduced by removal of THM precursors prior to the addition

of chlorine. The removal of humic substances by activated carbon was examined using commercially supplied humic acid, extracts of a Michigan Finch soil, and extracts of leaves from a local hardwood forest. The materials were characterized by molecular size fractionation, analysis of functional groups, and haloform formation potential. Haloform formation potential was found to be dependent upon material source. No correlations were found between the amounts of oxygen-containing functional groups and the potentials for haloform formation. Seven-day adsorption tests on a bituminous-base activated carbon revealed a source-dependent relationship for removal of humic substances. Adsorption of humic materials from different sources was inversely related to the number of carboxyl groups per unit weight of the substrate. Humic or fulvic acid species of lower molecular weights were more readily adsorbed, presumably due to greater surface areas. Soil fulvic acid adsorption increased with decreases in pH of the solution and increases in phosphate buffer levels. It was recommended that treatment performance for removal of humic substances from water be evaluated prior to treatment, especially when humic materials from different sources are present. (Geiger-FRC)
W81-00630

THE EFFECT OF SAN FRANCISCO'S WASTEWATER PLAN ON WATER QUALITY AND AQUATIC BIOLOGY,
California Univ., Los Angeles.
C. T. Hunsaker.
PhD dissertation, 1980. 192 p, 17 Fig, 20 Tab, 55 Ref, 3 Append.

Descriptors: *Waste water disposal, *California, *Sewage, *Water law, *Sewage bacteria, Aquatic populations, Bays, Coliforms, Pathogenic bacteria, Overflow, Assesments, Swimming, Fishing, Shellfish, Environmental Impact Reports, Waste water management, *San Francisco.

The City and County of San Francisco adopted a Wastewater Management Plan in 1980 that uses an ocean discharge system of eight average annual overflows, The conclusion is drawn that while any of the suggested alternatives would have improved ocean and bay water quality, that which called for just one overflow per year would have been the least adverse to recreatinal users (water contact and shellfishing) of the shoreline and near shore organisms. The five alternatives available were variations of two Master Plans allowing for one, four and eight average annual overflows, through either a deep-water outfall alone or to both the ocean and the bay. The environmental review process for the Master Plan is summarized with reference to water quality and aquatic biology, and describes the probable impact of effluent on bay and ocean shoreline study areas. It was difficult to gather scientific aquatic data for the five proposed alternatives because of a lack of scientific information on heavy metals and other potentially toxic substance concentrations in combined sanitary and stormwater overflow discharges. Federal and state water law, municipal treatment works and the environmental assessment process are described. (Garrison-Omniplan)
W81-00647

OPTIMIZING WATER TREATMENT PLANT OPERATIONS FOR SAVINGS OF WATER, ENERGY, AND CHEMICALS,
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.
A. C. Chao.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-137945, Price codes: A04 in paper copy, A01 in michrofiche. Report, October 1980. 48 p, 20 Fig, 2 Tab, 37 Ref. OWRT-A-108-NC(2), 14-34-0001-9035.

Descriptors: Alkalinity, Backwash, *Water treatment, *Ferric chloride, *Coagulation, Coagulants, Turbidity, Suspended solids, Hydrogen ion concentration, *Filters, Water conservation, Technology, *Filter backwash, Chemicals.

This study investigates the fesibility of reducing the dosage requirement of ferric chloride for the removal of colloidal particles from waters containing low alkalinity by manipulating the pH control of the coagulation process. When metallic salts such as ferric chloride are used as coagulants, the solution pH should be maintained at a certain optimum level to allow the formation of hydroxopolymers or hydroxide precipitates from the added coagulants. Since the chemical reactions result in reducing the solution pH, bases are simultaneously added to maintain a constant pH at the optimum level. This constant pH method has been practiced for laboratory coagulation studies and in water treatment. The results of laboratory studies indicate that a two-step pH control method can achieve the same removal efficiency as the constant pH method but at lower dosage requirements. The study also investigates the feasiblity of reducing the consumption of treated water for filter backwash. The current backwash practice employs a constant backwash rate of 18-25 gpm/ft sup 2 (50% bed expansion) for 5 - 15 minutes to clean a clogged filter. A new method employs an initial low backwash rate which causes only 10-15% bed expansion. At this bed expansion the sand grains are more efficiently scoured and cleaned than at the higher level for an effective rinsing of the filter bed. Laboratory studies indicate that the new backwash method is as effective as the constant rate method. Because of the low initial rates employed, the new method results in a saving of 30% water consumption. (Kiger-NC)
W81-00686

APPARATUS FOR EMERGENCY WATER PURIFICATION,
E. H. Pavia.
U.S. Patent No 4,196,081, 6 p, 6 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 244, April 1, 1980.

Descriptors: *Patents, *Water treatment, *Water purification, Filtration, Water quality control, Filters, Equipment, Potable water, Emergencies, Sequential filtering.

A method and apparatus for the purification of water in emergency situations is provided, comprising a manually operated pump having a discharge port connected to a number of series-connected treatment filters. Each filter is chosen for its ability to perform a desired purification function in a preferred sequence which enhances the performance of the subsequent filter in the series. The filters are designed to accept water from a contaminated source, thereafter removing particulate matter, and inorganic impurities and inorganic impurtities, and finally physically filtering out bacteria and other organisms larger than 0.20 microns in size to deliver potable water from the outlet port of the final filter. Preferably, all components are mounted in a suitable portable enclosure for ease of storing and for transporting the unit to a water source in an emergency situation. (Sinha - OEIS)
W81-00722

HOW VANCOUVER KEEPS ON TOP OF SEWER MAINTENANCE,
Superintendent of City Sewers, Vancouver (British Columbia).
T. Baker.
Water and Pollution Control, Vol 18, No 9, p 22, 24, 37, 43, September, 1980.

Descriptors: Domestic wastes.

Methods currently being used in sewer maintenance in Vancouver, British Columbia are reported by the city's Superintendent of Sewers. Closed-circuit television cameras are used in assessing the condition of sewers. Since 1965, a self-contained, truck-mounted flushing unit using high-pressure water has proved an effective and inexpensive unstopping method. A rodding machine has been used regularly since 1966 to clear sewers of tree roots. The herbicide Sanafoam Vaporooter has also been effective in treating root problems. Sewers have been relined using 12-24 inch PVC piping. A new English product, Insituform, has been used to reline pipes: a resin-impregnated felt bag is cut to measure, installed with cold water pressure, after which the water is heated to cure the resin. Spills of flammable liquids should be contained at the street level and removed or neutralized there. When there is an excess storm water problem, a portable smoke generator and blowers are used to check for possible connections between sanitary and storm sewers (if there is no connection, the smoke will blow out of house stacks; if there is a connection, it will blow out of the down spouts). Equipment used in unstops of property-to-municipal sewer hookups is also discussed. Repair of sewer breaks with rubber couplers is recommended. The records and map system used by the municipal department is also described. (Just-FRC)
W81-00727

SEWER GROUTS AND HOW TO USE THEM.
For primary bibliographic entry see Field 8G.
W81-00728

ENDOTOXINS, ALGAE AND LIMULUS AMOEBOCYTE LYSATE TEST IN DRINKING WATER,
Pittsburgh Univ., PA. Graduate School of Public Health.
J. L. Sykora, G. Keleti, R. Roche, D. R. Volk, and G. P. Kay.
Water Research, Vol 14, No 7, p 829-839, July, 1980. 4 Fig, 5 Tab, 20 Ref.

Descriptors: *Potable water, *Chlorophyta, *Bacteria, *Limulus amoebocyte lysate test, Water quality, Algae, Endotoxins, Analytical techniques, Bioassay, Public health, Regression analysis, Water supply, Pennsylvania, Pittsburgh(PA).

Five water systems in Allegheny county (Pittsburgh, PA) were selected to determine the relationship between various organisms in drinking water and the Limulus amoebocyte lysate (LAL) gelation titer. Non-specific reactions of the LAL assay were also analyzed. The greatest total lipopolysaccharide (endotoxins) levels as measured by the LAL assay were found in the reservoirs with high concentrations of algae and Standard Plate Count bacteria. Uncovered finished water basins were found to have the highest concentrations of phytoplankton. The major source of the 'endotoxic' response was a non-specific reaction caused by algae. Chlorella vulgaris (Chlorophyta) was the most common alga. The LAL test on samples grown in the laboratory verified the phenomenon observed on field samples and indicated a non-specific reaction. Cultures of Schizothrix calcicola, the most dominant Cyanobacterium found in the five water systems, grown under identical conditions produced a specific response. Alkali and lysozyme treatments were capable of distinguishing specific and non-specific LAL reactions. These two techniques and the LAL gelation test are recommended for the assessment of drinking water quality. (McKeon-FRC)
W81-00740

5G. Water Quality Control

MANAGEMENT OF THE HYDROLOGIC SYSTEM IN AREAS SUBJECT TO COAL MINING ACTIVITIES,
Utah Water Research Lab., Logan.
R. H. Hotchkiss, E. K. Israelsen, and J. P. Riley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127383, Price codes: A05 in paper copy, A01 in microfiche. UWRL Water Resources Planning Series P-80/05, October 1980. 84 p, 32 Fig, 16 Tab, 3 Append. OWRT A-046-UTAH(1), 14-34-0001-9047.

Descriptors: *Coal mines, *Multiple-purpose projects, *Water management(Applied), *Land management, Groundwater, Water supply, Water storage, Pumping, Water quality control, Inflow, Colorado River.

The report examines the effects of present mining activities on the associated hydrologic system, and identifies specific mining procedures and management techniques which not only minimize negative hydrologic impacts of mining operations, but which also enhance the value of the hydrologic

system in terms of existing and potential social uses. Thus, the results of the research contribute to the solution of present and future hydrologic problems (both quantity and quality) associated with coal mining in the western U.S. Emphasis is placed on sites which are representative of both existing and future coal mining areas. Specific objectives which are addressed and discussed in terms of actual coal mines in central Utah are (1) evaluation of the potential for using underground coal mines to tap previously inaccessible groundwater supplies, reduce the salt load to the Colorado River by decreasing the contact of groundwater with salt-bearing geologic formations, and store water in abandoned mines; (2) consider the potential effects of underground coal mines on water resources; and (3) evaluate the potential of using surface mined areas to collect surface runoff. The study suggests not only ways of reducing negative hydrologic impacts of mining operations, but also operational and management mining techniques which will enhance the social use value of the hydrologic systems, and thus, in fact, create hydrologic opportunities.
W81-00502

PHOSPHORUS MANAGEMENT FOR THE GREAT LAKES.
International Joint Commission-United States and Canada.
Final Report to International Joint Commission's Great Lakes Water Quality Board and Great Lakes Science Advisory Board, July, 1980. 129 p, 6 Fig, 9 Tab, 97 Ref, 2 Append.

Descriptors: *Phosphorus, *Great Lakes, *Planning, *Water quality, *Control systems, Evaluation, Economic impact, Alternate planning, Phosphorus compounds, Phosphates, Bodies of water, Lakes, Limnology, Aquatic environment, Water quality control, Assessment, Economics, Mathematical models, Model studies, Models, Social impact, Canada.

This report has presented the findings of the Phosphorus Management Strategies Task Force, appointed in the Spring of 1978 by the Great Lakes Science (Research) Advisory Board to investigate alternative strategies for the management of phosphorus inputs to the Great Lakes. Subsequently, the Task Force was expanded to also include interaction to the Water Quality Board of the International Joint Commission. The overall report has considered: the development of the 1978 Great Lakes Water Quality Agreement phosphorus target loads; evaluation of phosphorus inputs in the Great Lakes; review and evaluation of mathematical models for predicting limnological effects of changes in phosphorus loadings and the validity of target loads; costs and technologies of phosphorus control; social/economic impact assessment strategies; and phosphorus management strategy. The next major decision point in the Great Lakes phosphorus management program is anticipated in about five years. Twelve Task Force recommendations were determined for the immediate phase of a phosphorus management strategy. (Zielinski-IPA)
W81-00511

OIL-COLLECTING SHIP FOR OIL SPILLS,
Mitsui Shipbuilding and Engineering Co. Ltd., Tokyo (Japan).
H. Muneta.
U.S. Patent No 4,191,650, 5 p, 4 Fig, 4 Ref: Official Gazette of the United States Patent Office, Vol 992, No 1, p 248-249, March 4, 1980.

Descriptors: *Patents, *Oil spills, *Oil pollution, Water quality control, Skimming, Ships, Equipment, Collection.

A ship for collecting oil from oil spills floating on the surface of the sea comprises a pair of side hulls forming between them a flow passage through which a stream of oil-laden water will flow when the ship travels through the the floating oil. Between the side hulls, a center hull is provided in which a well is formed having a bottom which opens into the flow passage and through which the oil in the passage may float upwardly to be trapped in the well. A pump is provided to pump the trapped oil from the well. The bottom of the well is below the surface of the sea and the stream is deflected under the bottom by a forwardly-inclined segment extending between the side hulls. A splash plate is provided to overlie the upper end of the segment to direct the upward splashes from the segment over the top edge of the segment into a splash chamber behind the segment. The water and/or oil collected in the splash chamber may flow into the well through a connecting opening. (Sinha - OEIS)
W81-00521

APPARATUS FOR FILTER BACKWASHING,
Envirotech Corp., Menlo Park, CA. (Assignee).
E. A. Whitmore.
U.S. Patent No 4,191,652, 7 p, 4 Fig, 5 Ref; Official Gazette of the United States Patent Office, Vol 992, No 1, p 249, March 4, 1980.

Descriptors: *Patents, *Water treatment, *Water quality control, Filtration, Filters, Industrial water, Suspended solids, Equipment, Backwashing.

Water often contains particulate material which must be removed before it can be used. Many industrial processes require water which has only minimal quantities of particulate mater. One conventional method for removing particulate material from water is to pass the water downwardly through a bed of filter media comprising sand or some other granular material. As the process is carried out particulate material accumulates in the bed thus resulting in a loss of hydraulic head across the bed. After a substantial quantity of particles builds up in the bed the head loss becomes so great that it is necessary to stop the filtering process and remove the deposited particles. An object of this invention is to provide a filter with an air backwashing device having three cushions of air. Laterals with nozzles are placed below the filter media to convey backwashing air and water into the filter bed. Below the laterals are located a manifold and a distribution plenum to carry air into the laterals. The manifold and distribution plenum are separated by a common wall having ports. (Sinha - OEIS)
W81-00522

TREATMENT OF AQUEOUS SYSTEMS,
CIBA-GEIGY Corp., Ardsley, NY. (Assignee).
D. R. Clark, A. Marshall, and M. A. Finan.
U.S. Patent No 4,192,744, 7 p, 3 Fig, 3 Tab, 13 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 627, March 11, 1980.

Descriptors: *Patents, *Water treatment, *Water quality control, Demineralization, Scaling, Separation techniques, Alkali metals, Flocculation.

The invention provides a method of treating an aqueous system to selectively flocculate compounds of iron ions. A minor proportion of a compound is added in the presence of calcium ions to inhibit the formation of adherent alkaline scales. The compound may be used singly or in a mixture in an aqueous system to be treated in conjuction with other compounds known to be useful in water treatment. (Sinha - OEIS)
W81-00523

ION EXCHANGE METHOD AND APPARATUS,
Chromalloy American Corp., City of Industry, CA. (Assignee).
P. S. Meyers.
U.S. Patent No 4,193,868, 5 p, 2 Fig, 7 Ref; Official Gazette of the United States Patent Office, Vol 992, No 3, p 1003, March 18, 1980.

Descriptors: *Patents, *Water treatment, *Ion exchange, Water quality control, Separation techniques, Equipment, Flow control, Regeneration.

This invention provides an ion exchange apparatus constructed so as to utilize a single set or group of manifolds and channels for both service and regenerant flow but which is also constructed to handle comparatively large quantities of water at a comparatively low pressure during service use and to handle and distribute lesser quantities of regenerant solution at a higher pressure during regeneration of the ion exchange bed. Operation can be improved by using a check valve permitting flow in one direction to all of the channels as the bed is being employed under service conditions to treat water and permitting flow in the opposite direction in less than all of the channels as the bed is being treated with regenerant solution. (Sinha - OEIS)
W81-00524

EFFECTS OF BANK STABILIZATION ON THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF STREAMS AND SMALL RIVERS: AN ANNOTATED BIBLIOGRAPHY,
Missouri Univ., Kansas City. Dept. of Biology.
For primary bibliographic entry see Field 4D.
W81-00557

EFFECTS OF BANK STABILIZATION ON THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF STREAMS AND SMALL RIVERS: A SYNTHESIS,
Missouri Univ., Kansas City. Dept. of Biology.
For primary bibliographic entry see Field 4D.
W81-00559

IN-GROUND PRECIPITATION ENDS WELL-SCREEN PLUGGING,
K. Grover.
American City and County, Vol 95, No 4, p 55-58, April, 1980. 2 Fig.

Descriptors: *Wells, *Iron, *Manganese, *Chemical precipitation, Aquifers, Corrosion, Well casings, Aeration, Filtration, Sands, Costs, Metals, Municipal water, Injection, Hydrogen ion concentration, Oxidation-reduction potential, Gravels, Groundwater.

The first U.S. in-situ system to remove iron and manganese from well water supplies is being installed at Pembroke, Massachusetts. The town well at Pembroke plugged repeatedly in spite of costly cleaning steps and various efforts to sequester the iron. This new method includes an aeration procedure followed by sand filtration, as do other treatment methods. However, the new process, Vyredox, which was developed in Finland, uses the sand and gravel in the well itself as a filter. Conventional systems require chemical addition to cause precipitation, while Vyredox employs natural biochemical precipitation. Redox potential and pH are kept so high that iron and manganese are precipitated and retained in the sand-gravel layers of the aquifer. In a typical installation, a number of aeration wells are placed around a supply well. Water from an outside source is passed through an oxygenator for degassing and oxygen enrichment. This water is then injected into the aquifer. Since underground filtration is slower, it is assumed to be more efficient than above-ground filtration in removing iron and manganese. The process is suited to shallow sand-gravel aquifers. One disadvantage is the cost of determining whether the process will be successful at a given location. Pilot tests can cost about $40,000, $15,000 of which is for finished injection wells that will be used in the final installation. (Baker-FRC)
W81-00588

CROSS-CONNECTION CONTROL MEANS POTABLE WATER SAFETY.
American City and County, Vol 95, No 1, p 61-62, January, 1980. 1 Tab.

Descriptors: *Potable water, *Diseases, *Municipal water, *Water distribution(Applied), Water quality, Water pollution sources, Water pollution effects, Public health, Water pollution control, Sewerage, Distribution systems, Human diseases, Local governments, Legislation, Odor.

Various wasy to achieve cross-connection control for potable water supplies are considered. Cross-connections can occur whenever a potable system is connected to a non-potable supply operating at a higher pressure. The negative pressure or reduced pressure in the line causes backsiphonage. It is estimated that 90% of consumer complaints about

bad odors in the water in Cleveland can be traced to cross-connection problems. Of 3,926 cases of water borne disease caused by contamination through the distribution system and reported to the National Center for Disease Control between 1946 and 1970, 1,752 were attributed to cross-connections, and 785 were caused by backsiphonage. One method of achieving control requires the customer to install an approved backflow prevention device at each service connection. Other criteria necessary to establish a cross-connection control program include the designation of a single authority in charge of the program, understanding of state law and development of local ordinances, familiarity with various approved control devices, knowledge of installation procedures, periodic maintenance and testing, thorough record keeping, and organization of an effective public information program. Schemes which have been devised for this problem in Henrico County, Virginia and in Cleveland are briefly reviewed. (Baker-FRC)
W81-00589

METHODS FOR THE ISOLATION OF VIRUS FROM RAW AND DIGESTED WASTEWATER SLUDGE,
Royal Veterinary and Agricultural Univ., Copenhagen (Denmark). Dept. of Veterinary Virology and Immunology.
A. L. Nielsen, and B. Lydholm.
Water Research, Vol 14, No 2, p 175-178, February, 1980. 3 Tab, 14 Ref.

Descriptors: *Viruses, *Sewage sludge, *Sludge disposal, *Pollutant identification, *Tertiary treatment, Fertilizers, Soil contamination, Toxins, Environmental sanitation, Laboratory tests, Analytical techniques, Isolation, Separation techniques, Waste disposal, Waste water treatment, Adsorption, Temperature, Hydrogen ion concentration, Disinfection.

Increased interests in the use of sludge as fertilizer for land application has raised problems of the treatment of sludge for removal of viruses. Virus removal from sludge has been complicated by the lack of detection methods for viruses in sludge. Studies measuring the viral content of sludges that have been directly inoculated fail to account for the differences that may exist between indigenous viruses incorporated into sludge and artificially intruduced viruses that are absorbed onto the surfaces of particles. In the present study, four different quantitative techniques for the detection of viruses in waste-water sludges were tested on raw and digested sludge. Satisfactory results were obtained with acidic precipitation followed by elution with beef extract and alum precipitation followed by elution with tris buffer. Good recovery was also obtained with elution with beef extract even on sludge with high levels of total suspended solids. Direct inoculation of sludge into cell cultures was unfeasible due to the harmful effects of other sludge constitutents to cells. Viruses were found in all raw sludge samples and at a higher concentration than in digested sludge specimens. Some of the viral types identified were coxsackievirus B2 and B5, poliovirus 1, 2, and 3, and adenovirus 1 and 2. In one sample, adenovirus type 2 was detected one day after sludge application to land and in another sample, coxsackievirus B5 was identified 4 months after sludge application to land. (Geiger-FRC)
W81-00632

REDUCTIONS IN INACTIVATION RATES OF BACERIOPHAGES BY CLAY MINERALS IN LAKE WATER,
New York Univ., NY. Lab. of Microbial Ecology.
H. Babich, and G. Stotzky.
Water Research, Vol 14, No 2, p 185-187, February, 1980. 3 Fig, 24 Ref.

Descriptors: *Viruses, *Adsorption, *Clay minerals, *Lakes, *Pathogenic bacteria, Suspended solids, Suspension, Filtration, Disinfection, Bacteriophage, Path of pollutants, Water pollution sources, Enteric bacteria, Heat treatment, Humic acids, E. coli, Water quality control.

The effect of clay minerals on the survival of bacteriophages of Eschrichia coli and Staphylococcus aureus were studied in natural water samples from the freshwater Lake Kauneonga. Clay preparations of kaolinite, montmorillonite, vermiculite, or attapulgite clays were added at different concentrations to test tubes of lake water inoculated with two phages of E. coli and three of S. aureus. The test tubes were serially diluted with buffer and applied to appropriate host bacterial cultures on agal plates. Plaques were counted after 18 hr of incubation. Results showed variations in the stabilities of bacteriophages in natural lake water. The rate of inactivation of an S. aureus phage was found to be greatly reduced in the presence of clay minerals in either filtered or autoclaved or unautoclaved lake water with the sequence of protection being attapulgite>vermiculite>montmorillonite, kaolinite. The viral protection afforded by the clays was attributed to the adsorption of the viruses onto the clay particles in the lake water suspensions. Lake of protection of viruses by the addition of humic acids or heat-killed microbial cells in other experiments could have been due to the inability of these materials to successfully adsorb the viruses. (Geiger-FRC)
W81-00636

DEVELOPMENT OF CHLORINE RESISTANT MEMBRANE, ASYMMETRIC POLYIMIDE MEMBRANE AND POROUS SUBSTRATES,
Membrane Systems, Inc., San Diego, CA.
R. G. Sudak, J. M. Chirrick, R. L. Fox, M. E. McKee, and J. B. Bott.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142242, Price codes: A11 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, September, 1980. 234 p, 62 Fig, 92 Tab. OWRT-C-90176-D(No 9515)(1), 14-34-0001-9515.

Descriptors: *Membranes, *Research and Development, *Filtration, *Reverse osmosis, *Polymers, Permeability, Permselective membranes, Porous media, Films, Waste water treatment, Water pollution treatment, Water quality, Water qualtiy control, Pores, Plastics, Chlorination, Stability, Heat resistance, Membrane processes, Separation techniques, Semipermeable membranes, Synthesis, Water treatment.

This study was divided into three concurrent projects for development of (1) porous substrates for composite membranes, (2) chlorine-resistant membranes, and (3) asymetric polyimide membranes. Under (1) development of supports with different polymeric materials (other than polysulfone) was undertaken to increase: (a) the number of possible solvents for use in membrane barrier layer formation; and (b) the allowable temperatures for such formation. These new materials were developed with pore size variations for use in ultrafiltration/microfiltration applications as well as hyperfiltration. For polyimide porous supports, asymmetric membrances could be cast with a degree of permselectivity, undertaken to improve polyimide membrane reverse osmosis characteristics. Cellulose acetate is stable to low residual chlorine concentrations in feedwaters, but polyimide in sheet composite membrane or asymetric hollow fine fibers were not. Instability was attributed to secondary amines in the membrane barrier layer polymer. The mechanism of residual chlorine degradation of various polymers was investigated, which led to synthesis of several polymers and their subsequent reaction to form polyimide membrane layers. (Zielinski-IPA)
W81-00681

STATUS REPORT ON ABATEMENT OF WATER POLLUTION FROM THE CANADIAN PULP AND PAPER INDUSTRY (1978),
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
Report No EPS 3-WP-80-4E, May 1980. 23 p, 2 Fig, 10 Tab, 2 Append.

Descriptors: *Water pollution sources, *Pollution abatement, *Pulp wastes, Industrial wastes, *Canada, *Pulp and paper industry, Pulp wastes, Wastes, Water pollution, Sulfite liquors, Wood wastes, Paper industry, Lumbering, Abatement, Control, Water pollution control, Biochemical oxygen demand, Suspended solids, Fish toxins, Mills, Pollutants.

Canadian pulp and paper effluent regulations limiting the discharge of suspended solids, biochemical oxygen-demanding substances, and toxic materials were promulgated under Federal Fisheries Act in November, 1971. This report, presented in English and French, gave an assessment of progress made to 1978 in meeting discharge objectives, and projected future developments through to 1986. This assessment was a result of a review of individual mill operations and written complianace programs, and was developed through Environmental Protection Service regional personnel and provincial environmental agencies cooperation. Effluent discharges from the pulp and paper industry are presented in terms of total suspended solids (TSS), biochemical oxygen demand (BOD-5), and wastes toxic to fish. While pulp and paper production increased about 5% between 1976 and 1978, TSS discharges were reduced by about 14% and BOD-5 decreased by about 5%. TSS discharges decreased for all regions except the Pacific region, which remained stable; BOD-5 discharges were lower in all regions except Quebec, which remained the same as 1976. Mills in compliance for TSS and BOD-5 increased over the 1975/76 to 1978 period by 13 and 8, respectively. Fifty-four mills test toxicity of effluents to fish, but a large number of mills do not. (Zielinski-IPA)
W81-00703

METHOD AND DEVICE FOR REMOVING SOLID AND/OR LIQUID MEANS CONTAINING HARMFUL SUBSTANCES,
E. Crema.
U.S. Patent No 4,194,978, 11 p, 7 Fig, 2 Ref; Official Gazette of the United States Patent Office, Vol 992, No 4, p 1382, March 25, 1980.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Water quality control, Water reuse, Equipment, *Waste spills, Suction, Water jet pumps.

A method and apparatus for removing solid and/or liquid matter containing harmful substances from the ground or from the surface of water is described. A vacuum up to 0.1 bar is generated by a water jet pump, whereby the matter can be sucked up even over differences in height of almost 10 meters. The water jet pump is arranged in a closed water circulation system which uses a centrifugal pump for its drive, preferably a fire-extinguishing pump. In order to prevent the harmful substances from getting into the water circulation, a collecting vessel is arranged in the suction line for the harmful substances. (Sinha - OEIS)
W81-00713

PLEATED FILTER UNDERDRAIN, METHOD AND APPARATUS,
Harsco Corp., Wormleysburg, Pa. (Assignee).
T. D. Ward.
U.S. Patent No 4,196,079, 8 p, 8 Fig, 9 ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 243, April 1, 1980.

Descriptors: *Patents, *Water pollution treatment, *Filtration, Water purification, Filters, Waste water treatment, Equipment, Air circulation, Backwashing.

Filter beds for use in moving suspended solids from water supplies to meet present day requirments for potable water and waste effluent quality generally use a layer filter bed generally comprised of a graded sand and gravel media having gravel at the lowermost position, and the sand, anthracite coal and other fine media layered on top. A method and apparatus is described for air scouring a layered filter bed when air is dispersed into the finer particles of the bed without disturbing the coarse large aggregate in the lower portion of the bed to prevent inter-mixing of the fine aggregate with the large aggregate. The filter underdrain comprises a corrugated support structure forming peaks and valleys. The larger granular filter media

is placed in the lower portion of the valleys. The peaks of the filter support form air channels through which pressurized air is dispensed during the cleaning cycle to air scour the sand. Drainage apertures are formed in the lower portion in the gravel through which the filtered water flows into the lower portion of the channels and into storage facilities. (Sinha - OEIS)
W81-00721

APPARATUS FOR EMERGENCY WATER PURIFICATION,
For primary bibliographic entry see Field 5F.
W81-00722

FLOATING, SURFACE LIQUIDS RETRIEVAL SYSTEM,
E. T. Gordon.
U.S. Patent No 4,196,087, 12 p, 13 Fig, 12 Ref; Official Gazette of the United States Patent Office, Vol 993, No 1, p 246, April 1, 1980.

Descriptors: *Patents, *Oil spills, *Oil pollution, Water pollution treatment, Water quality control, Equipment, Floating, Separation techniques, Vacuum suction, Floating boom.

A floating retriever for retrieving spilled oil or other liquid substances on the top of water has a central liquid collection chamber with a vacuum or suction pick-up for delivery of the pollutants to a mother vessel. The Vessel controls the retriever by means of a boom structure. The retriever has a large surrounding circular float with intake ports with 'V' shaped lateral screws to bring the retrieved liquid to the collection chamber. The device includes an inverted-dome water well with limited openings underneath the collection chamber for stability, as well as radially positioned, selectively controlled, out-rigged screws including an auxiliary tow, for drawing the oil to the intake ports and providing for propulsion and guidance. The ports have inclined stepped bottom surfaces with discharge holes with a lower paddle wheel drive to initially enhance oil/water separation, as well as jets or sprays for producing a suction effect in the intakes. (Sinha - OEIS)
W81-00724

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

MULTIOBJECTIVE ANALYSIS IN THE MAUMEE RIVER BASIN: A CASE STUDY,
Case Western Reserve Univ., Cleveland, OH. Systems Engineering Div.
Y. Y. Haimes, P. Das, and K. Sung.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127524, Price codes: A11 in paper copy, A01 in microfiche. Completion Report submitted to the National Science Foundation and the Office of Water Research and Technology, October, 1979. 226 p, 12 Fig, 18 Tab, 71 Ref, 2 Append. OWRT-C-7047(No 6221)(6), 14-34-0001-6221.

Descriptors: *River basins, *Planning, *Mathematical models, *River basin development, Mathematical studies, Model studies, *Decision making, Data collections, Probability, Basins, Watershed management, Watersheds(Basins), Rivers, Bodies of water, Water resources planning, Comprehensive planning, Estimating equations, Statistical models, Input-output analysis, Optimization, Ohio, *Maumee River basin.

Systematic evaluation and identification of critical existing/future water/land resources problems in the Maumee River Basin was undertaken to consider formulation of a planning/management framework as a sound decision-making tool for the Basin. Planning was carried out with Maumee River Basin Level-B Planning Board cooperation, and the study results were used in Level-B planning and in formulating a recommended plan for the Basin. The study was divided into two phases. Phase I covered mathematical models development; integrating and testing the models with the available data base to determine their use as planning tools; and implementation of the Surrogate Worth Trade-off (SWT) method. Phase II covered analysis of Phase I results, improving the developed mathematical models, and evaluating the success of the SWT method; incorporating multiobjective water/land resources analysis into broader environmental/economic objectives; extending the hierarchical multiobjective structure and solution techniques; and documenting the overall experiences. Using SWT, decision-maker preferences and used only in the final analysis stages where surrogate worth functions are evaluated at specific points in the function space to determine the preferred solution. (Zielinski-IPA)
W81-00507

BASIN DEVELOPMENT AND WATER ALLOCATION,
Nevada Univ. System, Reno. Desert Research Inst.
J. W. Fordham, G. F. Cochran, H. N. Friesen, W. W. Pidcoe, and S. A. Bamberg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127276, Price codes: A04 in paper copy, A01 in microfiche. Publication No 41065, 1980. 53 p, 19 Fig, 9 Tab, 14 Ref, Append. OWRT-B-038-NEV(4) and B-050-NEV(2), 14-31-0001-3104, 14-31-0001-3612.

Descriptors: *Model studies, *Water resources development, *Nevada, *Semiarid climates, *Water rights, Mathematical models, Water law, Simulation analysis, Precipitation(Atmospheric), Snowmelt, Groundwater movement, Subsurface flow, Surface-groundwater relationships, Watersheds(Basins), *Great Basin.

Simulation techniques are described which would aid in the allocation of ground and surface water in semi-arid basins. The study area was Hualapai Valley in the northwestern Great Basin about 115 miles north of Reno, Nevada. The study was undertaken to simulate the combined surface and subsurface hydrology of a desert basin undergoing development and to determine the effects of the application of water right law on the hydrologic system. The utilization of the simulation models developed in conjunction with computerized water right information can provide the basis for approval or rejection of applications to appropriate water and criteria for allocation of water to users during periods of deficient supply.
W81-00514

LEAST COST DESIGN OF URBAN DRAINAGE SYSTEMS,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 4C.
W81-00552

INVOLVING THE PUBLIC IN WATER AND POWER RESOURCES DECISIONS,
Creighton and Creighton, Saratoga, CA.
J. L. Creighton.
Available from Supt. of Documents, GPO, Washington, DC 20402. Water and Power Resources Service Report, June 1980. 340 p, 21 Fig, 39 Ref, 2 Append. 8-07-83-V0709.

Descriptors: *Planning, *Water resources, Evaluation, Social aspects, Social participation, Decision making, Methodology, Public involvement.

This manual presents standards, instructions, and techniques for planning, implementing, and reporting public involvement programs. It is applicable to public involvement in the planning of large and small scale projects and progams that will significantly affect the public, and is specifically applicable to public involvement in water resources planning. The manual presents: the rationale and general principles for public involvement; guidelines and techniques for determining the need for public involvement, identifying the affected groups, and designing a public involvement program; organizational issues involved in administering and coordinating public involvement programs; techniques for designing and running public meetings, and methods other than public meetings for involving the public in the planning process. An appendix provides examples of printed materials for communication with the public, such as newsletters, public announcements, brochures and booklets. (Moore - SRC)
W81-00558

TEXAS LIGNITE: ENVIRONMENTAL PLANNING OPPORTUNITIES,
Fish and Wildlife Service, Fort Worth, TX.
T. J. Cloud, Jr.
Available from Supt. of Documents, GPO, Washington, DC 20402. Report FWS/OBS-78/26, June 1978. 19 p, 1 Fig, 1 Tab, 32 Ref.

Descriptors: *Strip mines, *Lignite, *Environmental effects, *Plannning, Texas, Land reclamation, Social aspects, Recreation, Wildlife, Vegetation, Coal mines, Public involvement.

To date, the adverse effects of lignite surface mining in Texas have been limited due to the small number of mining operations in existence. However, to meet future energy demands large areas of east and southcentral Texas will be strip mined for lignite. Aquatic, terrestrial, and recreational environmental impacts which will potentially be associated with lignite strip mining are discussed. Opportunities for proper environmental protection measures are proposed, including involving concerned agencies and the public in planning, the establishment of reclamation plans, and the development of information regarding the environmental requirements of plant and animal species. (Moore - SRC)
W81-00562

PROMISING METHODOLOGIES FOR FISH AND WILDLIFE PLANNING AND IMPACT ASSESSMENTS,
Fish and Wildlife Service, Denver, CO.
For primary bibliographic entry see Field 6G.
W81-00565

PLANNING REPORT FOR THE IRRIGATION PORTION OF A DUAL WATER SYSTEM FOR WEST JORDAN CITY, SALT LAKE COUNTY, UTAH,
Utah Div. of Water Resources, Salt Lake City.
For primary bibliographic entry see Field 3C.
W81-00649

ENVIRONMENTAL ASSESSMENTS IN WATER RESOURCES PLANNING.
Stanford Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W81-00704

6B. Evaluation Process

WATER REQUIREMENTS AND COSTS FOR SOUTH DAKOTA RURAL MANUFACTURING FIRMS,
South Dakota State Univ., Brookings. Dept. of Economics.
R. Hoffman, and T. L. Dobbs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131088, Price codes: A06 in paper copy, A01 in microfiche. Research Project Technical Completion Report, 1980. 108 p, 32 Tab, 19 Ref, 3 Append. OWRT A-071-SDAK(1), 14-34-0001-9044.

Descriptors: *Water requirements, *Water supply, *South Dakota, *Rural areas, *Industrial plants, *Cost analysis, Costs, Econometrics, Community development, Factories, Water use, Water distribution(Applied), Feasibility, Cost-benefit analysis, Instrumentation, Evaluation, Statistical methods, Statistics, Data collections, Economic feasiblity, Economic impact.

A mail survey of manufacturing firms, a personal survey of a subsample of manufacturing firms, and a personal survey of certain municipal offices pro-

vided the data for this study. Cross-tabulation was used to evaluate relationships among variables, covering firm type, water volume use, town size, water supply source, employment, special water supply considerations in firm location, water problems, and water-related facilities used by firms. Analysis of variance and regression tested for differences in water volume use among firm types, firm employment levels, and firms in varying town sizes. A budgeting procedure was used to estimate possible costs due to municipal water system expansion to accommodate a new firm. Firms of Instruments and Food manufacturing classifications averaged the highest water level use in 1978; while Lumber Products and Transportation firm classifications were among the lowest 1978 water consumers. Annual water use increased with firm employment size. Firms having production, heating, or cooling as their major water use used more water annually than firms using water principally for drinking and sanitation. Estimates of water use by industry type can be used by planners for water system expansion needs to accomodate new industry. (Zielinski-IPA)
W81-00550

INVOLVING THE PUBLIC IN WATER AND POWER RESOURCES DECISIONS,
Creighton and Creighton, Saratoga, CA.
For primary bibliographic entry see Field 6A.
W81-00558

TEXAS LIGNITE: ENVIRONMENTAL PLANNING OPPORTUNITIES,
Fish and Wildlife Service, Fort Worth, TX.
For primary bibliographic entry see Field 6A.
W81-00562

STRATEGY FOR ASSESSING IMPACTS OF POWER PLANTS ON FISH AND SHELLFISH POPULATIONS,
National Power Plant Team, Ann Arbor, MI.
E. S. Fritz, P. J. Rago, and I. P. Murarka.
Available from Supt. of Documents, GPO, Washington, DC 20402. Report FWS/OBS-80/34, July 1980. 80 p, 18 Fig, 87 Ref.

Descriptors: *Powerplants, *Environmental effects, *Shellfish, *Fish, Planning, Statistical models, Environmental impact.

The shortcomings of existing guidance documents and environmental impact assessments for power plants indicate the need for a strategy or plan which can enhance the efficiency of data collection and the reliability of conclusions. A strategy was designed for use by biologists responsible for conducting or reviewing assessments of impacts on fish and shellfish. The strategy consists of six steps: conceptualization of the ecosystem to be assessed; design and execution of needed pilot investigations; refinement of conceptualization; design of a study plan; execution of the study plan; and evaulation of impact. An interdisciplinary group consisting of a fisheries biologist, a physiologist and behaviorist, a biostatistician, a population dynamicist, a systems ecologist, and a design engineer is assembled to conduct the assessment. The strategy is the procedure for assessing the effects of a generalized electric generating facility site in an area where the impact on fish and shellfish is high. However, it can be applied to assessments for less sensitively sited facilities, site evaluation studies, assessments for existing facilities, and additions to existing facilities. (Moore - SRC)
W81-00563

OPERATIONAL STUDY FOR PLANNING PURPOSES OF A PUMP-STORAGE RESERVIOR SYSTEM,
California Univ., Los Angeles.
A. Tabatabaee-Diba.
MS thesis, 1980. 59 p, 19 Fig, 4 Tab, 22 Ref, 1 Append. Water Resources Center Archives, University of California, Los Angeles. UCAL-WRC-W-535.

Descriptors: *Pumped storage, *Reservoirs, *Hydroelectric plants, *Simulation analysis, *Planning, Reservoir yield, California, Demand, Pricing, Power marketing, Load distribution, Peak loads, Peak power, Hydrology.

Pump-storage technique is a promising method for production of hydroelectric energy and has become a significant element of the electric power systems of the 1980's. For planning purposes, a parametric search technique was used to study the revenue response of a pump-storage reservoir system to changes in demand and other operational constraints. The results show that the parametric study can be used effectively for project planning and operation of such a system. The Oroville-Thermalito reservoir system in northern California was selected for analysis, using sixty years (1914-1973) of monthly historical stream flows routed through the system in wet and dry weather cycles. Average yearly revenue from the sale of power was considered as the dependent variable. The independent variables were: (1) the requested or contractual power level; (2) the ratio of the total number of minimum on-peak hours to the total number of hours; and (3) the ratio of the value of the off-peak to the on-peak energy output. That the energy demand was treated parametrically suggests that the study is suitable for future planning purposes of the system. (Garrison-Omniplan)
W81-00646

EXPLORATIONS IN MULTIOBJECTIVE *WATER RESOURCE HISTORY,*
Massachusetts Inst. of Tech., Cambridge, MA. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
D. C. Major, R. Ambrose, and R. Coleman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-133415, Price codes: A05 in paper copy, A01 in microfiche. Technical Report, June, 1977. 87 p, 3 Tab, 76 Ref. OWRT-C-5172(No 4206)(1).

Descriptors: *Planning, *Water resources development, *Multiple-purpose projects, *Comprehensive planning, *Research priorities, Project planning, Water resources, Management, Water policy, Civil engineering, River basin development, Reclamation, Federal Government, Legal aspects, Political aspects, Economics, History.

In this exploratory study, several key programs were examined, using specified data sources to study each, to gain a perspective of the role of multiobjectives in the history of water resources planning in this country. Programs selected for study were the reclamation program and the 308 program, as well as a river basin planning effort that developed as a result of the 308 program. It was concluded from the sources studied that both the reclamation program and the 308 programs were multiobjective, but in different ways. The former, studied primarily through analysis of debates in Congress, was multiobjective with respect to regional and social aims (especially when related to the family homestead); while the latter contained multiobjective elements related to lives and safety with respect to monetary measures of national income benefits and costs. Congressional committee and floor debates on 308 projects might reveal a broader multiobjective character than the Corps reports. Three exceptional areas for follow-on studies were suggested by the exploratory study reported here. (Zielinski-IPA)
W81-00674

WATER AS A PARAMETER FOR DEVELOPMENT OF ENERGY RESOURCES IN THE UPPER GREAT PLAINS -- EFFECTS ON LAND AND WATER RESOURCES OF ALTERNATIVE PATTERNS OF COAL-BASED ENERGY DEVELOPMENT,
North Dakota Agricultural Experiment Station, Fargo.
D. F. Scott, G. H. Pfeiffer, and D. E. Gronhovd.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-133670, Price codes: A03 in paper copy, A01 in microfiche. Research Report No 70, December, 1978. 35 p, 7 Fig, 22 Tab, 27 Ref. OWRT-C-7187(No 6217)(1), 14-34-0001-6217.

Descriptors: *Great Plains, *Coal mines, *Cost analysis, *Land reclamation, *Surface water availability, Costs, Income, Geographical regions, North Dakota, Coals, Fuels, Fossil fuels, Montana, Wyoming, Industrial production, Planning, Coal mine wastes, Economics, State Governments, Water supply, Water utilization, Water users, Water demand, Water distribution(Applied), Cost-benefit analysis.

This report represents volume II of a two-volume study report on the analysis of the effects of alternative patterns of coal-based energy development in the Upper Great Plains on resource use, economic activity, and polulation distribution in the region. The volume addressed the effects of coal-based energy production on the region's land and water resources; Volume I addressed the effects on economic activity, population growth and settlement patterns, and the costs and revenues to State and local levels of government of coal development in the region. Volume II presented a detailed analysis of mined land reclamation costs in North Dakota (along with costs for selected mine sites in Montana and Wyoming); identified existing surface water supplies and use in the region; and discussed the impacts of alternative levels of coal development on water resources. Upper Great Plains energy development will have an impact on the region's water resources. It was concluded however, that available area water resources appear sufficient to satisfy needs of increased reliance on coal resources without undue hardship on sectors of the region's economy. Aggregate average water seemed available in sufficient quantity, but detailed planning will be needed for effective development. (Zielinski-IPA)
W81-00691

WATER AS A PARAMETER FOR DEVELOPMENT OF ENERGY RESOURCES IN THE *UPPER GREAT PLAINS -- SOCIOECONOMIC* EFFECTS OF ALTERNATIVE PATTERNS OF COAL-BASED ENERGY DEVELOPMENT,
North Dakota Agricultural Experiment Station, Fargo.
N. E. Toma, N. L. Dalsted, J. S. Wieland, and F. L. Leistritz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-133662, Price codes: A08 in paper copy, A01 in microfiche. Research Report No 71, December, 1978. 144 p, 59 Fig, 137 Tab, 24 Ref, 1 Append. OWRT-C-7187(No 6217)(2), 14-34-0001-6217.

Descriptors: *Great Plains, *Coal mines, *Cost analysis, *Welfare(Economics), *Computer models, *Social impact, Costs, Income, Geographical regions, North Dakota, Coals, Fuels, Fossil fuels, Montana, Wyoming, Industrial production, Planning, Coal mine wastes, Economics, State Governments, Water supply, Water utiliztion, Water demand, Mathematical models, Cost-benefit analysis.

This report represents Volume I of a two-volume study report on the analysis of the effects of alternative patterns of coal-based energy development in the Upper Great plains on resource use, economic activity, and population distribution in the region. The volume addressed the effects on economic activity, population growth and settlement patterns, and the costs and revenues to State and local levels of government of coal development in the region; Volume II addressed the effects of coal-based energy production on the region's land and water resources. Volume I presented a detailed conceptual description of a computerized model proven useful in North Dakota for projection of economic, demographic and fiscal effects on coal development; an in-depth analysis of the effects of three alternative levels of North Dakota coal development (and brief summaries for Montana and Wyoming); and discussions of existing/potential measures for alleviation of adverse fiscal effects resulting from coal development, and of socio-economic charcteristics of the coal industry's Upper Great Plains work force and a local labor supply model. Shortfalls of front-end financing to offset rapid energy development growth effects appeared as the most serious potential fiscal difficulty for all government levels. (Zielinski-IPA)

W81-00692

ASSESSMENT AND RECOMMENDATIONS FOR COMMUNITY WATER RESOURCES PLANNING.
Skidmore, Owings, and Merrill, Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-137911, Price codes: A07 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October, 1980. 132 p, 16 Fig, 80 Ref, 7 Append. OWRT-C-80104-P(No 8402)(1), 14-34-0001-8402.

Descriptors: *Planning, *Suburban areas, *Water resources development, *Local governments, *Legal aspects, State Governments, Massachusetts, Governmental interrelations, Federal Government, Governments, Administration, Water *allocation(Policy), Water demand, Water* distribution(Applied), Municipal water, Evaluation, Water conservation, Water utilization, Water *management(Applied), Cities.*

This study examined local planning in response to water supply shortages and related water quality and land management factors in a case study suburban town (Stoughton) near Boston, Massachusetts. Following initial survey of local water resource *issues in the study town, the study team provided* planning and technical assistance to aid the development of a local resource management strategy. *A six-step planning process was prepared and* tested, based on apparent guidance needs in resource planning techniques. It was concluded that local government appears to be the most appropriate body to deal with local resource mangagement issues, but also that it is often ill-equipped to do so. Local governments place heavy reliance on traditional structural solutions, which if inadequate, are replaced by more appealing non-structural options, yet, the latter often require sophisticated preparation/execution for success. These findings concur with regional, State, and Federal policies that emphasize local water resource self-sufficicency and resource preservation. Technical assistance efforts to communities are needed for communities to meaningfully respond to such policies. The study procedures employed have a broad potential application to numerous town and small cities in the United States. (Zielinski-IPA)
W81-00696

ENVIRONMENTAL ASSESSMENTS IN WATER RESOURCES PLANNING,
Stanford Univ., CA. Dept. of Civil Engineering.
L. Ortolano.
Water Supply and Management, Vol 2, No 2, p 159-176, 1978. 1 Fig, 3 Tab, 35 Ref. OWRT-C-4080(No 9017)(4).

Descriptors: *Environmental assessment, *Water resources planning, *Iterative open planning process(IOPP), *Evaluation, Environmental impacts, Regulation, Prediction, Impact identification, Models, Multi-objective planning, Research, Mathematical programming, Planning, Forecasting.

Since 1970 environmental assessments have been required for water resources planning studies undertaken by federal agencies responsible for water resources development in the U.S. These assessments are mandated by the National Environmental Policy Act of 1969 (NEPA) and by the Water Resources Council's 'Principles and Standards for Planning Water and Related Land Resources,' thereby elevating environmental quality to status of a formal planning objective. Environmental assessment methods are divided into three parts corresponding to impact identification, prediction and evaluation. For impact identification the methods are checklists, matrices, network diagrams and state-of-the-art reviews. Single discipline procedures (e.g., air, water quality models) and cross impact procedures (e.g., systems dynamics models) are methods for impact prediction. For impact evaluation there are environmental evaluation procedures (e.g., those using weighted average of factors); and multi-objective evaluation procedures (e.g., mathematical programming). However, studies indicate that the influence of environmental assessments on the outcome of water resources planning studies has not been great and there has been little integration of results into other aspects of the planning process. Environmental assessment activities can be linked with more traditional planning activities by the 'iterative, open planning process' method which relies on continual two-way communication between agency planners and interested citizens and government agencies. It also calls for the performance of four traditional planning activities: problem definition, formulation of alternatives, impact assessment and plan ranking. *(Iervolino-NC)*
W81-00704

EUTROPHICATION IN PEEL INLET-II. IDENTIFICATION OF CRITICAL UNCERTAINTIES VIA GENERALIZED SENSITIVITY ANALYSIS,
California Univ., Berkeley. Dept. of Biomedical and Environmental Health Sciences.
For primary bibliographic entry see Field 5B.
W81-00726

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

DESIGNING EQUITABLE WATER RATES: WHAT MANAGERS NEED KNOW,
Illinois State Commerce Commission, Springfield.
W. J. Ide.
Journal of the American Water Works Association, Vol 72, No 10, p 564-569, October, 1980. 9 Ref.

Descriptors: *Water rates, *Pricing, *Utilities, Public utilities, Governments, Water users, Management, Costs, Replacement costs, Rehabilitation.

Factors involved in establishing rates for water usage are discussed. These factors include a study of the revenue requirements, an allocation of cost to various classes of users, and designing of the *rate schedule. Revenue requirements for most* government-owned utilities, however, are usually determined on a cash or budget basis and consist of estimated cash requirements. The emphasis placed on cash needs results from the fact that government-owned utilities are mainly backed by bonds which must be repaid in cash. Items that must be included in the budget are replacements, normal extensions of service, and normal improvements. Major improvements may be included as appropriations. Factors discussed in the design of rate structures include decreasing block rates, modified decreasing block rates, constant unit price rates, flat rates, off-peak, interruptible, and seasonal rates, conservation rates, lifeline rates, and availability charges. It is emphasized that, in the current socio-economic situation, consumers are becoming increasingly aware of rate increases, and that water-utility management must understand the fundamental principles involved in determining the necessary funds and designing equitable water rates. (Baker-FRC)
W81-00593

THE FUTURE OF AGRICULTURAL WATER USE IN NEW MEXICO,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Economics and Agricultural Business.
For primary bibliographic entry see Field 6D.
W81-00643

AGRICULTURAL WATER USE AND COSTS IN CALIFORNIA,
California Univ., Berkeley.
For primary bibliographic entry see Field 3F.
W81-00644

6D. Water Demand

FRESHWATER USE CUSTOMS ON ROTA: AN EXPLORATORY STUDY.
Guam Univ., Agana. Water Resources Research Center.
For primary bibliographic entry see Field 7C.
W81-00640

THE FUTURE OF AGRICULTURAL WATER USE IN NEW MEXICO,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Economics and Agricultural Business.
G. Dawson.
In: A Quarter Century of Water Research, Proceedings of the Twenty-Fifth Annual New Mexico Water Conference, Apr. 24-25, 1980, WRRI Report No 124, Aug. 1980. p 203-217, 17 Ref. New *Mexico Water Resources Research Institute, New* Mexico State University, Box 3167 Las Cruces, NM 88003.

Descriptors: *New Mexico, *Agriculture, *Water quality, *Water costs, Food supply, *Economic impact, Farm management, Irrigation, Land use, *Projections, Energy developments, Projected planning,* Crop production, Regional economics.

The future availability of irrigated land for New Mexico is uncertain. Key elements of New Mexico's water law---doctrines of 'prior appropriation' and 'beneficial use'— have met the state's agricultural water requirements to date. However, with demand outstripping supply, prices can and will be paid to shift water from agricultrual uses to 'higher valued' uses such as energy production. Depressed crop prices in 1979 and economic forecasts of low prices for 1980 may result in farmers' selling their water instead of their produce. The Federal Intermediate Credit Bank of Wichita reported that loans for farming production purposes were up 32% from 1978. Valley irrigated land values have been increasing at an annual rate surpassing 7%. Predictions for farming in the year 2025 must consider local economic entities, local consumption and local processing. The water available for future agricultural needs depends on proper planning for and reservation of irrigated lands, population changes and water demand, water conservation practices, legal and market conditions, and utilization of saline water. (Vernale-Omniplan)
W81-00643

AN ANALYSIS OF RESIDENTIAL WATER DEMAND SCHEDULES IN ARKANSAS,
Arkansas Univ., Fayetteville. Water Resources Research Center.
R. K. Ford, and J. A. Ziegler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142309, Price codes: A06 in paper copy, A01 in microfiche. *Report, October, 1980. 123 p, 27 Fig, 4 Tab, 52* Ref.

Descriptors: *Arkansas, *Model studies, *Pricing, *Elasticity of demand, *Statistical models, *Water demand, *Forecasting, Consumptive use, Optimum development plans, Data collections, Profiles, Indicators.

Increases in population and water use require evaluation of the production and distribution of water, an economic good. Economic models are developed which identify the major factors affecting residential demand for water in each of the five Arkansas Water Resources Planning Areas. These factors include the price of water, price of other goods, water uses, financial resources of consumers, and quality of the water. The models are then used to estimate the effects of different rate policies on water demand and water system revenues. Information was gathered on prospective dependent variables using questionnaires mailed to individual households throughout Arkansas. The models are also capable of generating estimates of future water demand under changing conditions, and are useful in local, state, and national level planning of water pricing and public policy. (Garrison-Omniplan)
W81-00690

6E. Water Law and Institutions

REASONABLE GROUND WATER PUMPING LEVELS UNDER THE APPROPRIATION DOCTRINE: LAW, POLICY AND ALTERNATIVES,

Idaho Univ., Moscow. Coll. of Law.
D. L. Grant.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127540, Price codes: A06 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute, University of Idaho Completion Report, September, 1980. 114 p, 222 Ref. OWRT-A-066-IDA(1), 14-34-0001-0114.

Descriptors: *Groundwater, *Water table, *Water supply, Water wells, *Pumping plants, Prior appropriation, *Legal aspects, Groundwater availability, Subsurface waters, Pumping, Appropriation, Appropriable waters, Public benefits, Public rights, Constitutional law, Local governments, States, State governments, Water policy, Hydrology, Hydrogeology, Surface-groundwater relationships.

This study noted that water agencies in most Western States have not been quick to issue pumping level regulations, and urged the development of regulations that would prevent pumping levels from dropping too far. The dilemma centers on the observations that (1) the determination of reasonable pumping levels depend much upon public consensus, (2) no public consensus has yet emerged, but (3) specific answers cannot be left to the future. Public participation was recommended not only to gather information, but to disseminate data that can assist in crystallizing public consensus. The overall study investigated what factors should be considered in setting reasonable pumping levels in appropriation doctrine States. Groundwater hydrology elements and other groundwater management tools that affect pumping levels in such States were described. Various reasonable pumping level statutes were compared and contrasted, and possible contribution of modern cost-benefit analysis to the setting of pumping levels was assessed. The need to integrate noneconomic or social goals as well was investigated. Finally, several alternatives to the reasonable pumping level approach were evaluated. (Zielinski-IPA)
W81-00510

REGIONAL FIVE-YEAR RESEARCH AND DEVELOPMENT PLAN FOR PERIOD 1982-1987. PACIFIC NORTHWEST/OCEANIA REGION.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-132110, Price codes: A02 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, November 1, 1980. 18 p, 6 Append.

Descriptors: *Research priorities, *Pacific Northwest U.S., *Alaska, *Guam, *Hawaii, Idaho, Oregon, Washington, Research and Development, Water Quality, Water supply, Groundwater, Water pollution, Streamflow, Coasts, Water use, Institutional constraints, Legal aspects, Anadromous fish, Fisheries, *Five-year plans.

This plan, prepared under the Directors of the Water Resources Research Center/Institutes of Alaska, Guam and Micronesia, Hawaii, Idaho, Oregon, and Washington, covers the 1982-1987 period for the Pacific Northwest/Oceanic region. Seven broad regional research objectives were identified. These cover methodology development to determine/evaluate instream flows, quantity and quality of groundwater resources, environmental/economic tradeoffs due to resource development; and evaluation of the effect of policies/laws pertaining to water allocations for native and Federal reserved land utilization, the effect of land/ocean resource use/development on coastal water quality, the effect of alternate energy development on water resource management/supply, and the effects of international/interstate laws on shared water resources. Identified special problems included the analysis of problems and issues affecting the ability to sustain current water uses, with particular attention to survival of anadromous fisheries. Research summaries of the six Centers/Institutes have been included as appendices. (Zielinski-IPA)
W81-00547

WATER RESOURCES RESEARCH NEEDS IN NEW ENGLAND,
Maine Univ. at Orono. Land and Water Resources Center.
S. S. Hasbrouck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131146, Price codes: A02 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, November, 1980. 17 p.

Descriptors: *Research priorities, *New England, *Water Resources, Research and Development, *Water quality, *Water supply, Connecticut, Maine, Massachusets, New Hampshire, Rhode Island, Vermont, Groundwater, Water pollution, Surface waters, Sewage effluents, Acidic water, Runoff, Flooding, Water conservation, Water management(Applied), *Five-year plans.

This report represented the New England regional summary, covering Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont. A more thorough treatment of water research needs has been provided in the individual State reports. Water resource problems and associated research needs judged to be most critical from a broad New England regional perspective were assessed. Water resource problems affecting all New England States were categorized into water quality and water quantity issues. Water quality topics covered groundwater contamination/hazardous wastes; surface waters pollution by sewers; acid precipitation; runoff/lake eutrophication; recreation; and natural habitats protection. Identified water quantity topics were water supply and conservation; hydropower and other energy production; flooding and wetlands management; and allocation among competing demands. Technology transfer and information dissemination, regional allocation of water resources, and water resources and tourism were also considered. The widespread concern for groundwater management, acid rain, and institutional aspects of water resources management were identified as high priority candidates for regional emphasis. (Zielinski-IPA)
W81-00548

IMPLEMENTATION OF THE CONTROL OF POLLUTION ACT, 1974,
Severn-Trent Water Authority, Birmingham (England).
W. F. Lester.
Water Pollution Control, Vol 79, No 2, p 165-176, 1980. 1 Tab.

Descriptors: *Legislation, *Water pollution control, *Industrial wastes, *Sewage effluents, Municipal wastes, Pollution abatement, Water quality control, Pollutants, Water quality standards, Legal aspects, United Kingdom, Water Policy.

The Control of Pollution Act (COPA) was passed in Britain in 1974 and, although the segment dealing with waste disposal and the control of noise and of atomospheric pollution have been largely implemented, it will not be until 1980 that Part II, which cocerns water pollution, is implemented. Under the Act, the control of discharges of industrial and sewage effluent is extended to coastal waters and onto, as distinct from into, land. COPA provides for water authorities to renegotiate non-time-limited previous agreements made before 1937 concerning industrial effluent discharged into public sewers. Water authorities have the duty of stopping as soon as practicable pollution injurious to the fauna and flora of a stream produced as a consequence of a discharge, of arranging for the collection and disposal of waste from vessels, and of providing facilities for washing out sanitary appliances on vessels. The main benefit derived from the introduction of COPA will be in meeting the British government's desire for an open book approach to water pollution control work. The general public will be kept informed from advertisements relating to proposed significant new discharges and from public registers. A discussion follows the presentation of the paper. (McKeon-FRC)
W81-00579

HOW TO KEEP AHEAD OF THE REGULATORS,
Metropolitan Water District of southern California, Los Angeles.
V. E. Gleason.
Journal of the American Water Works Association, Vol 72, No 10, p 548-553, October, 1980. 1 Tab, 52 Ref.

Descriptors: *Legislation, *Water treatment, *Water districts, Regulation, Federal government, State governments, Local governments, Potable water, Water supply, Public utilities, Public health.

This article serves as a summary of regulations that deal with water supply systems. The purpose is to acquaint water system operators with the types of regulations that affect them. As government involvement increases, the amount of legislation and regulations will also increase. Water utilities must monitor more closely than ever the quality of drinking water supplies. Cooperation and significant evidence of attempts to improve working relationships with federal regulators can lead to protection against liability for damages resulting from unforeseen incidents which fall under the responsiblity of the regulator. Federal regulations discussed are the Safe Drinking Water Act of 1974, the Clean Water Act of 1977, The Clean Air Act, the Resources Conservation and Recovery Act, the Hazardous Materials Transportation Act, the Occupational Safety and Health Act of 1970, and the National Energy Conservation Policy Act of 1978. State and local regulations that are significant to water system supervisors include public utilities acts, state water supply statutes, environmental statutes, and water supply agreements. (Baker-FRC)
W81-00590

THE NEW REGULATORY CONSTRAINTS: FROM CONFLICT TOWARD COMPROMISE,
Black and Veatch, Dallas, TX.
H. J. Graeser.
Journal of the American Water Works Association, Vol 72, No 10, p 542-547, October, 1980.

Descriptors: *Legislation, *Water resources development, *Water law, Law enforcement, Legal aspects, Water supply, Water pollution sources, Administrative agencies, Regulation, Governmental interrelations.

Many laws have been passed in recent years dealing with the water industry and the development of water resources in the U.S. Such laws were often difficult to interpret and thereby created conditions conducive to adversary relationships between opposing government agencies, special interest groups, and the general public. Specific examples of conflicting interests and legal slowdowns are offered. The Limestone Reservoir experience illustrates how the provision of a wildlife reserve took priority over the supplying of drinking water to the people of the region. A second incident in Shreveport, Louisiana describes how delays endangered the area through inadequate drought yield and potential contamination of a single water supply reservoir. Some revision of section 404 has been achieved, mainly to the benefit of the Department of Agriculture and the farm lobby. Additional problems created by these laws are exemplified in the design constraints imposed by regulations directed against the supposed threat of cancer from trihalomethanes in drinking water. Possible federal aid in establiahing reasonable programs is described. (Baker-FRC)
W81-00591

THREADING THE REGULATORY MAZE: A SMALL UTILITY'S VIEW,
Thornton, CO.
C. R. Palmer, L. J. Gronning, and W. F. Ketellapper.
Journal of the American Water Works Association, Vol 72, No 10, p 554-557, October, 1980. 1 Fig.

Descriptors: *Federal government, *Municipal water, *Legal aspects, *Water policy regulation, Reservoir sites, Permits, Legal aspects, Planning,

Costs, Local governments, Governmental interrelations, Water resources development, Colorado.

The relationship of small municipal water authorities to the federal government is examined through the experiences of Thornton, Colorado and several other communities in the Denver region. Thornton has considered building a reservoir, but a reservoir built on private land without federal funds requires only a dredge and fill permit and review by the state engineer, while the same reservoir built on federal land or using federal funds requires approval by eleven additional federal agencies and two congressional committees. Thornton's membership in a Denver sewer district has brought the city into regulatory relationships with the EPA that have resulted in a 27% increase in chemical costs (for chlorination of raw water, the quality of which deteriorated after the Metro sewage treatment plant was loccated two miles upstream of the supply) and a need to restructure rate schedules. The Army Corps of Engineers has been reluctant to allow Thornton to reclassify an existing flood control reservoir as a multipurpose storage reservoir. Other communities have exerienced similar problems with regulatory agencies, sometimes resulting in added expense, long delays in obtaining permits and grants, and delivery problems. Under the recently introduced National Water Policy, increased state control of water planning and conservation programs are viewed as positive, but a stress on protecting unique historical and environmental areas and a requirement to quantify federal and Indian reserved water rights are viewed as potentially problematic for small communities. (Just-FRC)
W81-00595

EFFICIENT GOVERNMENT INSTITUTION FOR WATER QUALITY CONTROL,
California Univ., Los Angeles.
F. L. Harder.
PhD dissertation, 1980. 100 p, 4 Fig, 6 Tab, 106 Ref, 17 Append.

Descriptors: *Government interrelations, *State governments, *Water law, *Economic efficiency, Model studies, Water quality standards, *Water pollution control, Efficiencies, Expenditures, Welfare(Economics), History, Stream gages, Water quality control.

The government budget on all levels has increased absolutely and relatively in America since World War II and a continually larger percentage of the nations's resources are managed or owned directly by the government sector. This study hypothesizes that new government institutions are set up as an efficient approach to welfare maximization in a changing society. Beginning with a discussion of Michigan water policy, an evaluation of government effectivess is made by studying water pollution control methods in all fifty states. A model of state behavior consistent with the welfare maximization theory is developed. Six hypotheses concerning efficient state behavior in the control of water quality are proposed, based on the assumptions of the model: (1) states supply collective goods for their constituents; (2) the federal effect is directed toward reduction of interstate externalities; (3) states with more water spend more per capita on water quality control; (4) the income elasticity for water quality expenditures is positive, but less than one; (5) states with more land spend less on water quality control; (6) states are guided by their constituents' preference functions. The hypotheses were tested using state expenditures data and data on the state utility and water quality control functions. All six hypotheses were confirmed. The study concludes that the welfare maximizing model is useful for explaining state water quality behavior and likely has much broader applications. (Garrison-Omniplan)
W81-00648

RECLAMATION LAW, WATER DISTRICTS, AND POLITICS IN THE KINGS RIVER SERVICE AREA OF CALIFORNIA - AN ALTERNATIVE FRAMEWORK FOR ANALYSIS,
California Univ., Los Angeles,
P. L. Ballard.
MS thesis, 1980. 107 p, 1 Fig, 11 Tab, 44 Ref. University of California, Los Angeles, Water Resources Center Archives.

Descriptors: *California, *Water rights, *Water law, *Local governments, *Government interrelations, *Federal reclamation law, Political constraints, Political aspects, Water resources development, Water districts, Central Valley project, Social aspects, Rivers, Irrigation, Reclamation.

California's history contains many accounts of bitter political struggles over water resource allocation. A case study of the Kings River Service Area is used to examine the predominance of political conflict as opposed to political consensus, ideological bias versus value-neutrality, and social group domination rather than public welfare as the major determinants of public water resource allocation. Three 'objective functions' of an 'irrigation community ' are hypothesized: popular participation, orderly conflict resolution, and local control. The conclusion is that the interests of large farmers are antithetical to the interests of the larger community whose residents receive little benefit from large-scale agricultural activities. Conditions of conflict are created which cannot be resolved within the framework of local political processes. A process is suggested to build the foundations for a reinterpretation of the politics of water that would include an analysis of political institutions, the relationship beween the state and the market, the economic relations of water resource management, and the consequences of specific strategies for regional and inter-regional development. (Garrison-Omniplan)
W81-00650

INSTITUTIONAL PROBLEMS OF WATER QUALITY PLANNING (SECTION 208) IN URBANIZING AREAS,
Phillips, Brandt, Reddick and Associates, Inc., Irvine, CA.
T. E. Smith, Jr., and B. Bruesch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-136541, Price codes: A06 in paper copy, A01 in microfiche. Technical Report No 54-901, Prepared for Office of Water Research and Technology, October 1980. 65 p, 2 Fig, 7 Tab, 68 Ref. 3 Append. OWRT-C-90121-U(No 9432)(1), 14-34-0001-9432.

Descriptors: *Institutional constraints, *Legal aspects, *Water quality control, *Cities, *Federal Water Pollution Control Act, Water quality, Urban drainage, Urban runoff, Urbanization, Legislation, Water Quality Act, Water pollution, Surveys, Data collections, Evaluation, Census, Federal Government, Judicial decisions, Water law.

Institutional problems that occurred during development of areawide water quality management plans mandated by Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500) were investigated. Definition of such problems included conflicts and general competition between governmental units. Telephone interviews with area Project representatives, and secondary materials, served to assess institutional-related problems in ten designated 208 areas, one from an urban or urbanizing area in each Federal Region. Identified institutional problems common to most areas studied were: (1) lack of implementing powers and authorities inherent in Councils of Governments, and the voluntary nature of member agency participation, offered difficulties to effective institutional arrangements: (2) most designated management agencies were reluctant to finance measures for nonpoint pollution sources abatement; and (3) small towns and special purpose districts lacked commitments to implement 208 plan recommendations due to financial/attitudinal reasons for future research on institutional problems were delineated. (Zielinski-IPA)
W81-00672

FIVE YEAR PLAN OF WATER RESOURCES RESEARCH AND DEVELOPMENT FOR CONNECTICUT,
Connecticut Univ., Storrs. Inst. of Water Resources.
R. Young.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142291, Price codes: A04 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October 1980. 58 p, 7 Fig, 13 Ref.

Descriptors: *Research priorities, *Connecticut, *Research and Development, *Water resources, Water quality, Water supply, Lakes, Rivers, Groundwater, Water conservation, Water pollution, Water management(Applied), Acidic water, Potable water, Waste water(Pollution), Wetlands, Leachates, Soils, Toxins, Institutions, *Five-year plans.

The dominant concern for Connecticut was identified as the need for improvement, control, and protection of its existing potable water sources, in addition to the prevention of further damage to water quality of lakes, rivers and groundwater by undesirable wastes coupled to efforts to clean up water quality impairment sources. The most complex areas for research were identified as those dealing with institutional, economic and legislative matters. Many of these must be resolved prior to application of existing technical solutions. Identified problems resided in the areas of surface and groundwater quality and quantity, natural resources and ecology, insitutional coordination and legislation, and technology related to lake restoration. Fourteen principal research topics were priority-ranked, led by economic/institutional relations for aquifer protection, incentives for water use conservation, and industrial wastes disposal/treatment. The 14 topics were reduced by combination into seven research categories: acid precipitation; water resources allocation; drinking water and waste water; groundwater; lakes and wetlands; leachates and soils; and toxic and hazardous materials. Two funding allocations plans were developed for the research program elements. (Zielinski-IPA)
W81-00675

INSTITUTIONAL AND LEGAL PRESCRIPTION OF WATER USE AND MANAGEMENT,
Indiana Univ., Indianapolis. School of Law.
J. P. White.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138042, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center, Purdue University, West Lafayette, Indiana, Technical Report, September, 1980. 80 p, 2 Tab, 2 Append. OWRT-C-2172(No 3405)(1).

Descriptors: *Institutional constraints, *Legal aspects, *Water use, *Water law, *Indiana, Water policy, Riparian rights, Institutions, Governments, Water rights, Judicial decisions, Federal Government, States, Lakes, Water levels, Water level fluctuations, Navigable waters, Streambeds, Water users, Legislation.

Indiana has one of the most comprehensive State water regulatory systems. This report surveyed Indiana statutes and court decisions governing water use, and has highlighted deficiencies within this network that could lead to unnecessary future litigation. Indiana code definition of a public fresh water lake could unjustly affect riparian landowners rights. The Indiana lake water level statute requires modification providing more definite criteria in determining average water levels, and to specifically include/exclude non-riparians who may affect or be affected by lake levels, such as drainage basin owners. Other needs areas included definition of a navigable stream; and interpretation of what constitutes domestic use. There has been little incidence of case law interpreting the water law statutes. This study concluded that, while Indiana courts possess the power to construe statutes when needed, interpretations or modifications of the statutes made now by the general assembly could eliminate the possiblity of many cases ever arising. An overview of the Indiana water law system was presented, with recommendations/suggestions for system improvements to assure that State future water needs are met. (Zielinski-IPA)
W81-00678

FIVE-YEAR RESEARCH PLAN,
Maine Univ. at Orono. Land and Water Resources Center.
S. S. Hasbrouck, and P. D. Uttormark.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138026, Price codes: A03 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October, 1980. 25 p, 3 Tab, 34 Ref.

Descriptors: *Research priorities, *Maine, *Planning, *Research and Development, *Water resources, Groundwater resources, Acidic water, Water quality, Water pollution, Lakes, Water wells, Water pollution effects, Wetlands, Recreation, Recreation facilities, Rivers, Water conservation, Water use, Water demand, Legal aspects, *Five-year plans.

This research plan was developed under the auspices of the Maine Land and Water Resources Council, with the Council's Subcommittee on River Basin Planning serving as the primary advisory group. The study was limited to freshwater resources, with emphasis on management-oriented research. Information from 39 interviews and relevant reports led to the identification of five major areas and associated subareas: (1) groundwater management (water quality of private wells; land use loadings to groundwater; long-term and cumulative effects of contamination on groundwater systems); (2) acid precipitation; (3) lake management (conservation and aesthetic protection of developing lakes; protection of 'wilderness' lakes; water quality protection and enhancement); (4) river, stream, and wetlands management (impacts of expanding hydropower; agricultural impacts; impacts of forest spraying; stormwater impacts); and (5) recreational use of Maine's inland waters (public/private conflicts; recreation potential; recreational carrying capacities). Each of these subareas has been evaluated under the categories of (1) problem or situation; (2) what is being done; (3) research needed; and (4) questions to be answered. Groundwater management and acid precipitation were identified as areas of highest research priority. Projected annual fiscal allocations for the cooperative program over the 1982-1986 timescale were also developed. (Zielinski-IPA)
W81-00683

1982-1986 RESEARCH AND DEVELOPMENT PLAN FOR FLORIDA WATER RESOURCES RESEARCH CENTER,
Florida Univ., Gainesville. Water Resources Research Center.
J. P. Heaney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-138018, Price codes: A07 in paper copy, A01 in microfiche. Publication No 51, submitted to the Office of Water Research and Technology, October, 1980. 119 p, 16 Fig, 11 Tab, 51 Ref, 1 Append.

Descriptors: *Research priorities, *Florida, *Research and Development, *Water resources development, *Planning, Groundwater, Flood plains, Flooding, Saline water intrusion, Wetlands, Water pollution sources, Water quality, Water conservation, Drainage, Evaluation, Cost analysis, Institutions, Governments, Legal aspects, Institutional constraints, State Governments, *Five-year plans.

This research and development plan, developed from a variety of information resources, identified research needs in five categorical areas. The five identified areas (and the highest priority research needs in each respective area) were: (1) Atmospheric, Hydrologic and Hydraulic Processes (pollutants to groundwater, flood plains management, and saline intrusion); (2) Hydrologic-Ecologic Relationships (wetlands, lake and reservoir quality, non-point sources, and acid rain); (3) Water Quality Monitoring and Protection (water treatment processes); (4) Water Development, Use, Conservation, and Management (water conservation in industry and agriculture, and drainage); and (5) Institutional and Economic Analysis and Water Resources Planning (floods, integrating water and land use management, legal constraints, and control of water use). Florida's rainfall (annual average of 56 inches) replenishes streamflow and groundwater aquifers, with the Foridian aquifer serving as the major water supply source for the State. Much water movement in southern Florida is regulated by control structures, the largest State project of which is the Central and Southern Florida Flood Control Project. Close to seven billion gallons of water are withdrawn daily, about equally from surface sources and groundwater; and used for irrigation (42%), thermoelectric power generation (24%), public supply (16%), industrial purposes (14%), and rural supply (4%). (Zielinski-IPA)
W81-00684

A FIVE YEAR WATER RESEARCH PLAN FOR THE STATE OF ARKANSAS,
Arkansas Water Resources Research Center, Fayetteville.
R. E. Babcock.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142283, Price codes: A04 in paper copy, A01 in microfiche. Publication No 72, submitted to the Office of Water Research and Technology, August, 1980. 45 p, 9 Tab.

Descriptors: *Research priorities, *Arkansas, *Planning, *Research and Development, *Water resources, Water resources development, Water quality, Groundwater, Water pollution, Mining, Aquifers, Waste water(Pollution), Legal aspects, State Governments, Institutions, Industrial wastes, Institutional constraints, Agriculture, Recreational facilities, Water demand, *Five-year plans.

Competing water resource needs in Arkansas fell into three major categories: agricultural activities; recreational and resort development; and municipal and light industry. Heavy industry (lignite mining and other energy-related processes) represents near-future water resource needs. Management of State water needs will depend on a consistent and available data base in concert with a functional institutional framework. Identified research priorities over 1980-1985 for the Arkansas Water Resources Research Center were summarized under four water categories established by the Commission on Natural Resources, National Research Council: (1) Atmospheric, Hydrologic, and Hydraulic Processes: hydrologic characteristics of the Vadose zone; and hydrologic inputs to water quality monitoring; (2) Ecological-Environmental Relationships: effects of contamination on aquatic ecosystems; (3) Water Quality Protection: waterborne virus research; and control of contaminants resulting from energy development, including lignite mining; and (4) Water Resource Management: comprehensive data base in information dissemination system development; and institutional framework studies on alternative ways of moderating conflicting water use needs. Six principal goals were identified for the Arkansas Water Research Center for the 1980-1985 period, including a comprehensive study of nutrient/sediment loading on Beaver Reservoir in northwest Arkansas and its impacts, and of waste water impacts on groundwater aquifers and impoundment eutrophication. (Zielinski-IPA)
W81-00693

FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT PLAN: FISCAL YEARS 1982-1986.
Washington State Water Research Center, Pullman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142259, Price codes: A03 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, October, 1980. 41 p, 2 Fig, 4 Tab, 47 Ref.

Descriptors: *Research priorities, *Washington, *Planning, *Research and Development, *Water resources, Water resources development, Water quality, Water quantity, Groundwater movement, Volcanoes, Water pollution, Water pollution sources, Legal aspects, State Government, Institutions, Institutional constraints, Fisheries, Toxicity, Pollutants, Water use, *Five-year plans.

Use of the State of Washington's water resources and identified water resource problems were summarized under water quantity, hydroelectric production, flooding potential, water quality concerns, waste disposal, groundwater and lake water quality, community water supplies, industrial concerns, fisheries, wild/scenic rivers, recreation, and effects of Mt. St. Helens. Research needs were assigned Highest, Intermediate, or Lowest priority rankings, based on specific ranking criteria. Those having highest priority rankings were identified under five research areas: (1) effects of Mt. St. Helens' eruption (toxic effects on salmon/steelhead fisheries; chemistry/products occurring in watersheds/waterways of devastated areas; watershed characteristics in devasted/ash-impacted areas; study of mud flow mechanics); (2) water quantity problems (irrigation conservation methods; groundwater movement and contaminant dispersion; dam safety; basic hydrologic/hydraulic studies); (3) water quality problems (measurement of pollutants entering major freshwater streams in urban/agricultural areas and major State groundwater aquifers; long-term accumulative effects on aquatic ecosystems; small hydroelectric development impacts); (4) institutional problems (studies on Federal-State conflicts on hydroelectric/agricultural development and fisheries survival; Indian reservations water use potential); and (5) fisheries problems (effects of river operations methods on anadromous fisheries; fishery habitat rehabilitation; mortality reduction for downstream migrants). (Zielinski-IPA)
W81-00694

REGIONAL FIVE-YEAR WATER RESEARCH AND DEVELOPMENT GOALS AND OBJECTIVES.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-137952, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Institutes, Missouri River Basin States, Report submitted to the Office of Water Research and Technology, November 1980. 84 p, 14 Fig.

Descriptors: *Research priorities, *Missouri River, River basin, States, *Regional analysis, Planning, *Research and development, *Water resources, Water resources development, Water quality, Surface-groundwater relationships, Water conservation, Water utilization, Sediments, Pollutants, Irrigation efficiency, Institutions, State governments, Legal aspects, Institutional constraints, Wetlands, Riparian rights, *Five-year plans.

This coordinated regional plan for 1982-87 was prepared by the Directors of the Water Resources Research Institutes/Centers in the Missouri River Basin States (Iowa, Kansas, Missouri, Montana, Nebraska, North Dakota, South Dakota, Wyoming) that had each prepared five-year research and development plans. Thirty-eight regional problem areas were identified under six water research categories (water quantity, water quality, institutional water problems, utilization and conservation of water, energy-water relations, and ecological-environmental relationships in water resources). Fifteen of these problems were judged as highest priority for immediate attention: basin water distribution; groundwater systems and groundwater-surface water interaction dynamics; sediment; nonpoint pollution sources; State water development goals; control/ownership of waters; ground/surface water allocation; efficient water use in food/fiber production; lack of institutional incentives for conservation; conservation impacts on hydrologic systems; irrigation energy costs; energy development water needs; instream flow needs; wetlands hydrology dynamics; and sediments/pollutants impacts on aquatic/riparian ecosystems. Estimated funding percentages in the six research categories of the annual cooperative program for the eight regional States were developed. (Zielinski-IPA)
W81-00699

WATER RESOURCES RESEARCH PROGRAM: FIVE-YEAR PROJECTION (1982-1986), PENNSYLVANIA WATER RESOURCES RESEARCH CENTER,
Pennsylvania State Univ., University Park. Inst.

for Research on Land and Water Resources.
A. J. McDonnell, and W. K. Hood, III.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142275, Price codes: A04 in paper copy, A01 in microfiche. Report submitted to the Office of Water Research and Technology, December 1980. 52 p, 6 Fig, 15 Tab, 25 Ref, 2 Append. 14-34-0001-0140.

Descriptors: *Research priorities, *Pennsylvania, *Planning, *Research and development, *Water resources, Water quality, Water quantity, Water pollution, Water pollution sources, State governments, Institutions, Legal aspects, Institutional constraints, Waste water(Pollution), Waste water treatment, Acid mine water, Mine drainage, Waste disposal, *Five-year plans.

Significant issues identified relevant to water quality included groundwater pollution; non-point source pollution from acid mine drainage and other sources; environmental response/impact; and pollution control technology. Water quantity-related issues included stormwater drainage; floods; and surface/groundwater availability, supply, and use. The identified five-year research projections (1982-1986) included recommended programs in non-point source prediction and control; acid mine drainage control; acid precipitation; mine spoils reclamation; land cycling of wastes; treatment technology (including on-lot disposal); environmental assessment; stormwater management; in-stream needs; water conservation; groundwater management; and water allocation. Social, legal, economic, and other institutionally-related aspects pertinent to these areas were considered. Final specific activities fall under 11 Program Activity areas, covering floods, stormwater drainage, water supply, groundwater supply, environmental effects (including models), non-point source pollution, land disposal of wastes, energy/water interface, treatment technology, planning and management, and basic research - high risk. Waste water treatment and reuse is the highest funded present program area (32.7%) among seven other current program areas. (Zielinski-IPA)
W81-00700

6G. Ecologic Impact Of Water Development

PROMISING METHODOLOGIES FOR FISH AND WILDLIFE PLANNING AND IMPACT ASSESSMENTS,
Fish and Wildlife Service, Denver, CO.
L. R. Porter, G. W. Towns, L. W. Carlson, J. F. Hamill, and V. F. Fresquez.
Report, October 1979. 35 p, 8 Fig, 3 Tab, 5 Ref, 2 Append.

Descriptors: *Wildlife habitats, *Water resources development, *Coal mines, *Mapping, Planning, Methodology, Computer programs, Environmental effects, Fish, Stream fisheries, Reservoirs, Streamflow, Colorado, Yampa River basin.

The purpose of this study was to develop capabilities to: address incremental and cumulative impacts on fish and wildlife of multiple development actions in basin-wide settings, and evaluated alternative development scenarios from the standpoint of impacts on fish and wildlife. The Yampa River basin in northwest Colorado was used as the study area. Tools and methods described include a computerized Geographic Information System (GIS), conflict mapping, ranking of project impacts, and prediction of fish habitat changes resulting from multiple water developments. The GIS allowed manipulation and analyses of mapped information that would have been impractical manually. Mapped wildlife data were composited to determine habitat values of land units in the study area. Proposed locations of coal and water developments were overlaid on the composited wildlife maps to identify potential conflicts. A method was devised to quantify and compare relative impacts of different development scenarios on wildlife. A reservoir-streamflow analysis was initiated to predict changes in stream fisheries habitat resulting from proposed water developments. (Moore - SRC)
W81-00565

ECOLOGICAL COMPARISON OF INTERMITTENT STREAMS IN DIFFERENT LAND USE PATTERNS IN NORTHEASTERN ILLINOIS,
Louisville Univ., KY. Systems Science Centre.
For primary bibliographic entry see Field 2E.
W81-00645

7. RESOURCES DATA

7B. Data Acquisition

APPLICATIONS OF REMOTE SENSING IN HYDROLOGY,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
W. D. Striffler, and D. C. Fitz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127425, Price codes: A05 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University, Completion Report No 99, September, 1980. 76 p, 14 Fig, 3 Tab, 100 Ref, 2 Append. OWRT-B-160-COLO(7).

Descriptors: *Remote sensing, *Hydrology, Surface waters, Subsurface waters, *Aerial photography, Watershed characteristics, *Satellites(Artificial), Wetlands, Snow cover, Water quality, Soils, Vegetation, Mapping, Available water, *Instrumentation, *Landsat.

This paper is a summary of the potential applications of remote sensing in the field of hydrology. It includes an introduction to remote sensing, the physical principles of electromagnetic energy and many of the available sensors. Operational uses and research applications of remote sensing in areas related to watershed management are summarized.
W81-00505

A WATERSHED INFORMATION SYSTEM,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
A. G. Thomsen, and W. D. Striffler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-127433, Price codes: A07 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University Completion Report 100, September 1980. 97 p, 57 Fig, 34 Tab, 19 Ref. OWRT-B-160-COLO(8).

Descriptors: *Remote sensing, *Model studies, *Mountain watersheds, Hydrology, Snowmelt, Runoff forecasting, Topography, Vegetation, Soils, Forest management, Watersheds(Basins), Mapping, *Colorado, *Rocky Mountains, *Landsat.

A watershed information system for the analysis and simulation of mountain watersheds is described. Watershed information on topography, vegetation and soils in digital terrain models (overlays) serve as the data base for watershed analysis, classification of snow in Landsat imagery and automatic generation of parameter decks for operating distributed simulation models of snowcover dynamics and streamflow generation. The computer programs that generate the parameter decks have built-in calibration options for all major processes, that permit fast model calibration from an interactive computer terminal, on watersheds with varying characteristics. Options are available for simulating the effects of forest management alternatives (thinning, clearcutting) on selected forest stands. Snow course measurements and Landsat imagery are used for simulation update. Examples of output from subsystems are included to illustrate the capabilities of the information system.
W81-00506

BASE PEAK PROFILES OF GAS CHROMATOGRAPHY-MASS SPECTROMETRIC DATA OBTAINED FROM THERMAL DESORPTION OF ACTIVATED CARBONS,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
K. Alben.
Analytical Chemistry, Vol 52, No 12, p 1821-1824, October, 1980. 3 Fig, 1 Tab, 18 Ref.

Descriptors: *Adsorption, *Activated carbon. *Waste water treatment, *Gas chromatography, *Spectrophotometry, Liquid wastes, Water quality control, Data storage and retrieval, Engineering, Sampling, Computer models, Organic wastes, Volatility, Thermal properties, Chemical properties, Analytical techniques.

Thermal desorption gas chromatography-mass spectrometry is a sensitive specific method for analyzing volatile compounds. It has potential application in monitoring the abundance and chemical composition of organic substances removed by adsorption onto activated carbon in waste water treatment. This method produces electron impact data and chemical ionization data which can be stored in two-dimensional base peak format. Such data reveals the chemical identity of organic compounds and can be used by engineers and chemists. The format is useful in comparative studies and for historical profiles. In samples drawn from water treatment plants, major contaminants were identified from 0.1 g of carbon. This method is more sensitive than the carbon chloroform extraction method, and it can be applied to more volatile compounds. Its disadvantage is the complexity of the data which requires an on-line computer for acquisition, storage, and interpretation. (Titus-FRC)
W81-00569

DETERMINATION OF CHEMICAL OXYGEN DEMAND USING AN OPEN-TUBE METHOD,
Yorkshire Water Authority, Leeds (England). Office of Scientific Services.
K. E. De Casseres.
Water Pollution Control, Vol 79, No 1, p 143-145, 1980. 4 Tab, 7 Ref.

Descriptors: *Chemical oxygen demand, *Analytical techniques, *Testing procedures, *Laboratory equipment, Safety factors, Aromatic compounds, Laboratory tests, Methodology, Statistics, Water vapor, Volatility, Sewage treatment, Digestion, Oxygen requirements, Water quality, Pollutants, Water analysis.

COD of water samples was determined by a semi-micro open-tube method. Results were compared with those obtained by a conventional sealed-tube method. Tests for precision, percent recovery using synthetic COD standards, recovery of volatile compounds, and COD determined in real samples showed that the open-tube method is comparable to the closed-tube method with safer operating capabilities. For example, mean by analysis in mg/liter of potassium hydrogen phthalate samples with a theoretical COD of 800 mg/liter was 789 by open tube and 809 by sealed tube; corresponding figures for percent recovery were 98.6 and 101.1%. Mean recovery by open tube and sealed tube, respectively, of ethanol (500 mg/liter) was 479 and 481, of methyl-iso-butyl ketone (700 mg/liter) was 644 and 639, and of acetone (500 mg/liter) was 463 and 458. Mean COD in mg/liter in real samples by open and sealed tubes, respectively, was 265 and 275 for domestic crude sewage and 304 and 314 for industrial crude sewage. In addition, the open-tube method may be conducted using larger tubes (26 mm) and cones to permit in situ titration. However, smaller tubes offer more advantages when large numbers of COD analyses must be carried out. (Geiger-FRC)
W81-00571

AUTOMATED DISTILLATION-SPECTOPHOTOMETRY PROCEDURE FOR DETERMINING AMMONIA IN WATER,
Ontario Ministry of the Environment, Rexdale, Water Quality Branch.
For primary bibliographic entry see Field 5A.
W81-00576

AN EMPIRICAL KINETIC MODEL OF TRIHALOMETHANE FORMATION: APPLICATIONS TO MEET THE PROPOSED THM STANDARD,

Montgomery (James M.), Inc., Pasadena, CA.
For primary bibliographic entry see Field 5F.
W81-00596

BLANKING SYSTEM FOR THE SPECTROPHOTOMETRIC DETERMINATION OF AMMONIA IN SURFACE WATERS,
Ontario Ministry of the Environment, Rexdale. Water Quality Branch.
For primary bibliographic entry see Field 5A.
W81-00598

ON-COLUMN CRYOGENIC TRAPPING OF SORBED ORGANICS FOR DETERMINATION BY CAPILLARY GAS CHROMATOGRAPHY,
Washington Univ., Seattle Dept. of Environmental Health.
D. Kalman, R. Dills, C. Perera, and F DeWalle.
Analytical Chemistry, Vol 52, No 12, p 1993-1994, October, 1980. 3 Fig, 8 Ref.

Descriptors: *Gas chromatography, *Separation techniques, *Cryogenics, *Organic compounds, Analytical techniques, Design data, Collants, Laboratory test, Waste water, Sludge, Mass spectrometry, Condensation, Water analysis.

A simple on-column cryogenic trap for capillary analysis which can be made from common materials is described. The trap can be used for the purge-and-trap analysis of waste water and sludge samples by capillary column gas chromatography when the sample is complex and additional resolution is required. Three different cold trap designs were tested; all three used liquid nitrogen as the coolant. The first (design A) used copper as the trap, the second (design B) used aluminum plates and the third (design C) used stainless steel tubing. All three designs were mountable form a central support or could be supported by the liquid nitrogen supply tube. Each covered about 10 cm of the column providing a residence time of about 0.2 seconds for flow rates between 1 and 2 ml/minute. Thirty-four samples representing all of the EPA priority purgables except arolein and acrylonitrile were tested on the three traps and were analyzed by gas chromatography. Results from design A showed poor peak shape Lnd occasional split peaks for compounds more volatile than dichloromethane. Design B gave satisfactory resolution but its equipment was considered too cumbersome to install. Design C offered good resolution performance plus ease of installation to capillary columns. The flow of coolant and air to and from the trap can be readily automated. This cryogenic trap may also be used for headspace analysis and for determining concentrations of organics form large gas samples. (Geiger-FRC)
W81-00600

DETERMINATION OF ALPHA-CHLOROACETANILIDES IN WATER BY GAS CHROMATOGRAPHY AND INFRARED SPECTROMETRY,
Monsanto Agricultural Products Co., St. Louis, MO. Research Dept.
J. W. Worley, M. L. Rueppel, and F. L. Rupel.
Analytical Chemistry, Vol 52, No 12, p 1845-1849, October 1980. 9 Fig, 2 Tab, 9 Ref.

Descriptors: *Water analysis, *Gas chromatography, *Spectrometry, *Alpha-chloracetanilides, Chemical analysis, Herbicides, Water quality, Regression analysis, Analytical techniques, Statistical methods, Water pollution sources.

General sampling and analytical methods for determination of members of the herbicidal alpha-chloroacetanilide class at low ppb levels (0.5-14.3 ppb) in water are reported. The method includes extraction of a water sample with methylene chloride, concentration and solvent exchange for toluene/methanol, and gas chromatographic (GC) analysis. Quantitation is done by a nitrogen-selective detector. Structural confirmation is by on-the-fly GC-infrared (GC-IR) spectrometry. Recovery and linearity of response for each of the seven acetanilides investigated by nitrogen-selective GC from low ppb levels up to 100-300 ppb levels were found to be excellent. The method was rigorously validated in the 0.2-10 ppb range. GC-IR spectrometry provided useful chemigrams (time-dependent plots of the infrared absorbance integrated over a chosen frequency range) and characteristic infrared spectra from mixtures containing 1.0 micrograms of each of the acetanilides tested. GC-IR is therefore a viable tool for confirming structures of acetanilides in water at low ppb levels. (McKeon-FRC)
W81-00601

GAS CHROMATOGRAPHIC-MASS SPECTROMETRIC ANALYSIS OF CHLORINATION EFFECTS ON COMMERCIAL COAL-TAR LEACHATE,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
K. Alben.
Analytical Chemistry, Vol 52, No 12, p 1825-1828, October, 1980. 5 Fig, 1 Tab, 23 Ref.

Descriptors: *Chlorination, *Organic compounds, *Coal tar coatings, *Potable water, Halogens, Leachate, Water pollution sources, Chemical reactions, Water analysis, Gas chromatography, Mass spectrometry, Laboratory tests, Analytical techniques, Linings.

Mass spectrometric analyses suggest that chlorination significantly modifies the distribution of polycyclic aromatic hydrocarbons (PAH) in samples of commercial coal-tar leachate. Coal tar is often used as a lining for storage tanks and pipes in water supply systems. Analyses of mutagenic base-neutral compounds were conducted for laboratory samples of coal-tar leachate and chlorinated coal-tar leachate. The chlorinated samples revealed diminished concentrations of phenanthrene and fluoranthene and the absence of higher-molecular-weight PAH. Fluorene became prominent, oxygen-substituted PAH increased, and new oxygenated compounds were found. Intermixed with these were low concentrations of chlorine- and bromine-substituted PAH. Such chlorine and bromine compounds have also been found in investigations of chloroform produced by chlorination of potable water. Chlorination of coal-tar leachate is further expected to result in the formation of PAH with polar acidic function groups. Further studies of potable water systems for evidence of coal-tar contamination should benefit by screening for effects observed experimentally. (Titus-FRC)
W81-00603

ON THE VALIDITY OF THE CODISTILLATION MODEL FOR THE EVAPORATION OF PESTICIDES AND OTHER SOLUTES FROM WATER SOLUTION,
Oregon State Univ., Corvallis. Enviromental Health Sciences Center.
C. T. Chiou, and M. Manes.
Environmental Science and Technology, Vol 14, No 10, p 1253-1254, October, 1980. 6 Ref.

Descriptors: *Distillation, *Pesticides, *Model studies, *DDT, *Polychlorinated biphenyls, Evaporation, Water vapor, Vapor pressure, Aqueous solutions, Chlorinated hydrocarbon pesticides, Solutes, Gas chromatography, Analytical techniques, Laboratory tests.

Evidence is presented to demonstrate that the codistillation model is invalid when chemical-water mixtures are evaporated in a highly humid or supersaturated atmosphere. The model was originally supported by agreement of results from conventional steam distillation calculations with data on evaporative loss rates of pesticides and water. The present study showed that rapid evaporative loss of some low-vapor-pressure compounds from water is not always due to codistillation. When a stream of air maintained at 25C and a relative humidity of 98% was passed over water containing DDT, after 64 hours, the solution gained 412 g of water and lost 76% of its DDT by evaporation. Similarly, an aqueous solution of PCB at 0-2C gained 45 mg of water and lost 20% of its PCB when left for 6 hours in ambient air 0f 25C and 36% relative humidity. Since the evaporative loss of water and solute may occur independently of each other, it was suggestd that another term besides codistillation be used to describe such evaporative losses so that mechanistic coupling of two separate processes will not be assumed. (Geiger-FRC)
W81-00604

WATER SOLUBILITY AND OCTANOL/WATER PARTITION COEFFICIENTS OF ORGANICS. LIMITATIONS OF THE SOLUBILITY-PARTITION COEFFICIENT CORRELATION,
Syracuse Research Corp., NY. Life Sciences Div.
S. Banerjee, S. H. Yalkowsky, and S. C. Valvani.
Environmental Science and Technology, Vol 14, No 10, p 1227-1229, October, 1980. 2 Fig, 1 Tab, 11 Ref.

Descriptors: *Solubility, *Mathematical models, *Organic wastes, Water pollution, Adsorption, Water quality, Standards, Laboratory tests, Volatility, Aromatic compounds, Analytical techniques, Organic compounds, Equations.

The 1-octanol/water partition coefficient (K) has been used extensively in environmental fate studies to predict biological and physical phenomena such as bioaccumulation and soil adsorption. The water solubility (S) and K values for 27 organic compounds from the list of 65 Consent Decree Chemicals for which the US EPA is currently recommending water-quality criteria were determined from radioactively labeled samples. Results showed that the previously described Chiou correlation between K and S was not always valid for solids with high melting points. It was recommended that estimations of K or S for liquids should be made using the Hansch correlation. Another equation was proposed for estimating K or S for solids with known melting points. When the melting point is not known, the estimate may be made from an average value of KS obtained from compounds of similar structure. Tests with the high-melting compound RDX demonstratd that a serious error may result when Chiou's correlation is applied indiscriminantly for the determination of K or S. (Geiger-FRC)
W81-00605

INTRODUCTION (SPECIAL ISSUE ON THE PROGRESS OF AN ON-GOING PROGRAM TO IMPROVE METHODOLOGIES FOR THE ANALYSIS OF PRIORITY POLLUTANTS IN WASTE WATER EFFLUENTS),
Villanova Univ., PA.
R. L. Grob.
Journal of Environmental Science and Health (A), Vol 15, No 5, Special Issue, p 379-391, 1980.

Descriptors: *Pollutant identification, *Analytical techniques, *Data collections, Water pollution sources, Environmental Protection Agency, Separation techniques, Gas chromatography, Industrial wastes, Legislation, Methodology, Waste water(Pollution), Effluents.

A special issue of the journal is devoted to reporting progress in an on-going program to improve analysis methodologies for priority pollutants in industrial waste water effluents. Relevant legislation and the history of the Organic Chemicals Branch of the EPA in developing regulatory guidelines and applicable methodologies are reviewed. A program devised to develop the Best Available Control Technology Economically Achievable (BAT) analytical data base incorporates screening to determine which of the 129 priority pollutants are present, verification to quantify the pollutant load of industrial products/processes and the performance of treatment systems, and self-monitoring to extend the first two stages by adding time depth to the data base. Methods have been published in the Federal Register. Validation of analytical procedures used in these methods, especially in verification, requires the development of new techniques suited to specific matrices. Gas chromatography/conventional detector methodology was selected for verification because it allows generally superior quantification via recovery data, it is more cost effective for samples containing few priority pollutants, it allows faster laboratory turnaround, and instruments and qualified personnel are widely available. Performance and cost expectations have proved accurate. All 13

methods for 14 classes of organic priority pollutants use microextraction, headspace, or purge and trap (heated/unheated) extraction techniques. Cooperation among industry, private laboratories, and government agencies emerges as a dominant theme in this program. (Just-FRC)
W81-00609

AN AUTOMATED METHOD FOR THE SIMULTANEOUS DETERMINATION OF NITROGEN AND PHOSPHORUS IN PLANT MATERIAL, SLUDGE AND SOIL,
Water Research Centre, Stevenage (England).
K. W. Petts, and M. Belcher.
Water Pollution Control, Vol 79, No 3, p 399-404, 1980. 1 Fig, 6 Tab, 1 Ref.

Descriptors: *Analytical techniques, *Colorimetry, *Phosphorus, *Nitrogen, Spectrophotometry, Ammonia, Phosphorus compounds, Sludge, Soil analysis, Nutrients, Chemical analysis, Plant tissues, Sewage sludge, Digestion, Sampling.

This semi-automated method for the determination of nitrogen and phosphorus involves controlled digestion with sulfuric acid of up to 40 samples in a thermostatically regulated heating block, followed by automatic colorimetric analysis of the digest solutions for both amonia and orthophosphate concentrations. Nitrogen and phosphorus are determined in concentration ranges of 0-2.25% and 0-0.75% respectively. Materials with greater concentrations of these elements can be diluted. The method is discussed in detail with a description of the pretreatment of samples, digestion procedure, presision, accuracy, standards, reagents, and analytical procedure. Where the color of the acid digest solution may influence the calculated phosphorus content, a correction may be applied by using a conversion table. Since it is difficult to produce standard samples of plant material, sludge, and soil, it is suggested that the standard samples should be samples of the material being investigated. Using this analytical procedure, one analyst can run 80 samples per day. (McKeon-FRC)
W81-00622

BIOOXIDATION IN A CONTINUOUS ACTIVATED SLUDGE PROCESS,
Instytut Kształtowania Środowiska, Katowice (Poland). Dept. of Water and Wastewater Treatment.
J. Suschka.
Water Research, Vol 14, No 3, p 197-205, March, 1980. 14 Fig, 6 Tab, 16 Ref.

Descriptors: *Oxidation, *Activated sludge, *Mathematical models, Biodegradation, Bilogical treatment, Chemical degradation, Waste water treatment, Equations.

An extensive examination of the biochemical oxidation rate theory in the activated sludge process has suggested the need for a new critical equation to relate the overall biochemical reaction rate on the activated sludge to the oxidation process. The new equation which was based on many years of laboratory tests, pilot studies, and full scale experiements, calculates the substrate removal rate as a function influent and effluent substate concentration and detention time. Application of the equation showed that the overall reaction rate of sludge biochemical oxidation was not dependent on the substrated concentration in the effluent. Results of treatments by single and multistage activated systems may be predicted from the proposed equation. It seems feasible that the suggested equation may be used in process modelling because of its proven validity in wide ranges of activatd sludge loads. However, a commentary on the proposed new equation points out that the evidence to back up the mathematical model proves poor in most cases and this solution to the problems of measuring the kinetics of biodegradation may be illusory. (Geiger-FRC)
W81-00624

EUTROPHICATION IN PEEL INLET-I. THE PROBLEM-DEFINING BEHAVIOR AND A MATHEMATICAL MODEL FOR THE PHOSPHORUS SCENARIO,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5A.
W81-00725

SENSORY PROPERTIES AND ANALYSIS OF TWO MUDDY ODOUR COMPOUNDS, GEOSMIN AND 2-METHYLISOBORNEOL, IN WATER AND FISH,
Helsinki Univ. (Finland). Dept. of Limnology.
For primary bibliographic entry see Field 5A.
W81-00748

7C. Evaluation, Processing and Publication

A LABORATORY DATA-PROCESSING SYSTEM,
Severn-Trent Water Authority (England). Upper Trent Div.
D. R. Woods, M. D. Frayn, and R. S. Walker.
Water Pollution Control, Vol 79, No 1, p 42-55, 1980. 3 Fig, 6 Tab, 4 Ref.

Descriptors: *Computer programs, *Data storage and retrieval, *Data processing, *Laboratory tests, *Water sampling, Data collections, Monitoring, Water analysis, Measurement, Chemical analysis, Automation.

An experimental laboratory data-processing system provides a controlled method for the calculation of analytical results from raw data and for compiling routine analytical reports on sewage effluent samples. The system processes data on samples generated by a routine timetable from known sources. It utilizes a desk-top computer and line printer for which a 5 digit coding system was developed. Programs for all calculations of results for regular chemical determinations of water quality were constructed. In addition, utility programs were developed to edit stored data and to list out samples and their values. Raw data is stored in individual files assembled after analysis. Programs and data files for specified analyses are housed on a single tape and can be output separately. Each program includes instructions to flag gross errors and errors of analytical inaccuracy, and checks against predetermined limits. This system is more versatile than manual methods and increases the rate of throughput of samples. It is limited by the small storage capacity of the tapes. (Titus-FRC)
W81-00575

FRESHWATER USE CUSTOMS ON ROTA: AN EXPLORATORY STUDY.
Guam Univ., Agana. Water Resources Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131476, Price codes: A08 in paper copy, A01 in microfiche. Technical Report No 17, 1980. R. A. Stephenson and D. Moore, Editors, 141 p, 37 Photo, 10 Fig, 86 Ref, 2 Append. OWRT A-009-GUAM(2), 14-34-0001-8012, 9012.

Descriptors: *Freshwater, *Water supply, *History, Available water, Water utilization, Behavior, Social values, Social aspects, Guam, *Rota, *Mariana Islands, Micronesia.

Seventy-one Rotanese informants recounted in detail their customs, practices and beliefs concerning freshwater uses before and during World War II to the research team. An archaeological survey was also conducted to suggest possible locations of freshwater sources on Rota in prehistoric and historic times. Research on the ethnohistory of Rota serves to link the past to the present. The results of the research suggest that consistency is shown on Rota from the past to the present in regard to the value of freshwater. Before and during the war, local people were resourceful in building catchments, wells, and the like in order to insure sufficient supplies of freshwater. In the present, Rotanese people express confidence that they will continue to have sufficient supplies of freshwater to meet their daily needs.
W81-00640

STRUCTURE CONTOUR MAP OF THE MADISON GROUP, HAVRE 1 DEGREE BY 2 DEGREE QUADRANGLE, NORTH-CENTRAL MONTANA,
Geological Survey, Billings, MT. Water Resources Div.
R. D. Feltis.
Available from Montana Bureau of Mines and Geology, Butte, MT. Price $2.50. Montana Bureau of Mines and Geology Geologic Map 9, 1980. 1 Sheet, 2 Ref.

Descriptors: *Maps, *Hydrogeology, *Geohydrologic units, *Aquifers, *Montana, Structural geology, Faults(Geologic), Carbonate rocks, Subsurface mapping, *Madison Group, *Havre quadrangle, Bearpaw Mountains arch, Little Rocky Mountains, Hogeland basin, *Water-bearing formations.

The configuration of the top of the Madison Group, of Mississippian age, is shown by contours on a base map at a scale 1:250,000. The map is one of a series of maps produced as part of a regional study of the geohydrology of the Madison Group in north-central Montana. Contour intervals are 100 and 500 feet. The configuration map shows the approximately 50-mile-long west-trending Bearpaw Mountain arch (Bearpaw Mountains), with the Hogeland basin to the north along the international boundary. The steep dips along the north edge of the Little Rocky Mountains show the effect of a massive laccolith that uplifted and tilted sedimentary rocks. Detailed structural geology is not shown, but a stippled pattern shows where complex folding and faulting of the rocks probably have occurred. (USGS)
W81-00652

STRUCTURE CONTOUR MAP OF THE TOP OF THE MADISON GROUP, GREAT FALLS 1 DEGREE BY 2 DEGREE QUADRANGLE, NORTH-CENTRAL MONTANA,
Geological Survey, Billings, MT. Water Resources Div.
R. D. Feltis.
Available from Montana Bureau of Mines and Geology, Butte, MT. Price $2.50. Montana Bureau of Mines and Geology Geologic Map 10, 1980. 1 Sheet, 3 Ref.

Descriptors: *Maps, *Hydrogeology, *Geohydrologic units, *Aquifers, *Montana, Structural geology, Faults(Geologic), Carbonate rocks, Subsurface mapping, *Madison Group, *Great Falls quadrangle, Sweetgrass arch, Little Belt mountains, Highwood mountains, Disturbed belt, *Water-bearing formations.

The configuration of the top of the Madison Group, of Mississippian age, is shown by contours on a base map at a scale of 1:250,000. The map is one of a series of maps produced as part of a regional study of the geohydrology of the Madison Group in north-central Montana. Contour intervals are 100 and 500 feet. The configuration map shows mostly a moderate dip northeast from the South arch part of the Sweetgrass arch and from the north flank of the Little Belt Mountains. Southwest of the south arch the dip is steeper into the area of the disturbed belt. At the northeast side of the Little Belt Mountains the dip is into the Judith Basin (east of map area). In the Highwood Mountains area, where igneous instrusions of Tertiary age occur, the Madison Group has not been uplifted enough to be exposed at the surface, and the contour alignment is only slightly more erratic than in surrounding areas. Detailed structural geology is not shown, but a stippled pattern shows areas where complex folding and faulting of the rocks probably have occurred. (USGS)
W81-00653

STRUCTURE CONTOUR MAP OF THE TOP OF THE MADISON GROUP, SHELBY 1 DEGREE BY 2 DEGREE QUADRANGLE, NORTH-CENTRAL MONTANA,
Geological Survey, Billings, MT. Water Resources Div.
R. D. Feltis.
Available from Montana Bureau of Mines and Geology, Butte, MT. Price $2.50. Montana Bureau of

Mines and Geology Geologic Map 11, 1980. 1 Sheet.

Descriptors: *Maps, *Hydrogeology, *Geohydrologic units, *Aquifers, *Montana, Structural geology, Faults(Geologic), Carbonate rocks, Subsurface mapping, *Madison Group, *Shelby quadrangle, Sweetgrass hills, Kevin-Sunburst dome, Scapegoat-Bannatyne trend, *Water-bearing formations.

The configuration of the top of the Madison Group, of Mississippian age, is shown by contours on a base map at a scale of 1:250,000. The map is one of a series of maps produced as part of a regional study of the geohydrology of the Madison Group in north-central Montana. Contour intervals are 100 and 500 feet. The configuration map shows mostly the northeast regional dip from the Sweetgrass arch (southwest of map area). The map also shows most of the Kevin-Sunburst dome. The steeply dipping structure around the laccoliths that formed the Sweet Grass Hills along the international boundary is in marked contrast to the more gentle dips across the rest of the map. Detailed structural geology is not shown, but a stippled pattern shows areas where complex folding and faulting of the rocks probably have occurred. (USGS)
W81-00654

STRUCTURE CONTOUR MAP OF THE TOP OF THE MADISON GROUP, LEWISTOWN 1 DEGREE BY 2 DEGREE QUADRANGLE, NORTH-CENTRAL MONTANA,
Geological Survey, Billings, MT. Water Resources Div.
R. D. Feltis.
Available from Montana Bureau of Mines and Geology, Butte, MT. Price $2.50. Montana Bureau of Mines and Geology Geologic Map 12, 1980. 1 Sheet, 4 Ref.

Descriptors: *Maps, *Hydrogeology, *Geohydrologic units, *Aquifers, *Montana, Structural geology, Faults(Geologic), Carbonate rocks, Subsurface mapping, *Madison Group, *Lewistown quadrangle, Little Rocky Mountains, North Moccasin Mountains, South Moccasin Mountains, Judith Mountains, Cat Creek anticline, Blood Creek syncline, Big Snowy anticlinorium, Judith Basin, *Water-bearing formations.

The configuration of the tip of the Madison Group, of Mississippian age, is shown by contours on a base map at a scale of 1:250,000. The map is one of a series of maps produced as part of a regional study of the geohydrology of the Madison Group in north-central Montana. Contour intervals are 100, 500, and 1,000 feet. The configuration map shows the location of the Blood Creek syncline, a broad, rather shallow, east-plunging structural depression bordered on the northeast by the Little Rocky Mountains and on the south by the Judith Mountains and Cat Creek anticline of the Big Snowy anticlinorium. The steeply dipping structure around the several mountains shows the effect of massive laccolithic intrusions of Tertiary age that uplifted and tilted the sedimentary rocks. A major fault extends along the steep northeast flank of the Cat Creek anticline. West of the North and South Moccasin Mountains, the Judith Basin is shown as a major south-trending reentrant from the Madison Group, which regionally dips northeast. Detailed structural geology is not shown, but a stippled pattern shows where complex folding and faulting of the rocks probably have occurred. (USGS)
W81-00655

WATER RESOURCES DATA FOR MASSACHUSETTS AND RHODE ISLAND, WATER YEAR 1979.
Geological Survey, Boston, MA. Water Resources Div.
Geological Survey Water-Data Report MA-RI-79-1, September, 1980. 349 p, 5 Fig.

Descriptors: *Massachusetts, *Rhode Island, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water-resources data for the 1979 water year for Massachusetts and Rhode Island consist of records of stage, discharge, and water quality of streams; contents of lakes and reservoirs; and ground-water levels. This report contains discharge records for 102 gaging stations, monthend contents for 30 lakes and reservoirs, water quality for 26 gaging stations, and water levels for 108 observation wells. Also included are data for 19 low-flow and 20 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. A few pertinent stations (not included above) in bordering States are also included in this report. These data represent that portion of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Massachusetts and Rhode Island. (USGS)
W81-00656

WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1979--VOLUME 1. MISSOURI RIVER BASIN, AKANSAS RIVER BASIN, AND RIO GRANDE BASIN.
Geological Survey, Lakewood, CO. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-124992, Price codes: A22 in paper copy, A01 in microfiche. Geological Survey Water-Data Report C0-79-1, August 1980. 499 p, 4 Fig, 4 Tab.

Descriptors: *Colorado, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Missouri River basin(CO), *Arkansas River basin(CO), *Rio Grande basin(CO).

Water-resources data for Colorado for the 1979 water year consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs, and water levels and water quality of wells and springs. This report (volumes 1, 2, and 3) contains discharge records for about 460 gaging stations, stage and contents of 22 lakes and reservoirs, 4 patial-record low-flow stations, 93 crest-stage partial-record stations, and 200 miscellaneous sites; water quality for 143 gaging stations and 130 miscellaneous sites; and water levels for 55 observation wells. A few pertinent stations in bordering States are also included in this report. The records were collected and computed by the Water Resources Division of the U.S. Geological Survey. These data represent that portion of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Colorado. (USGS)
W81-00669

WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1979--VOLUME 2. COLORADO RIVER BASIN ABOVE DOLORES RIVER.
Geological Survey, Lakewood, CO. Water Resources Div.
Geological Survey Water-Data Report C0-79-2, July, 1980. 397 p, 4 Fig, 4 Tab, 41 Ref.

Descriptors: *Colorado, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Colorado River basin(CO).

Water-resources data for Colorado for the 1979 water year consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs, and water levels and water quality of wells and springs. This report (volumes 1, 2, and 3) contains discharge records for about 460 gaging stations, stage and contents of 22 lakes and reservoirs, 4 partial-record low-flow stations, 93 crest-stage partial-record stations, and 200 miscellaneous sites; water quality for 143 gaging stations and 130 miscellaneous sites; and water levels for 55 observation wells. A few pertinent stations in bordering States are also included in this report. The records were collected and computed by the Water Resources Divsion of the U.S. Geological Survey. These data represent that portion of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Colorado. (USGS)
W81-00670

WATER RESOURCES DATA FOR COLORADO, WATER YEAR 1979--VOLUME 3. DOLORES RIVER BASIN, GREEN RIVER BASIN, AND SAN JUAN RIVER BASIN.
Geological Survey, Lakewood, CO. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-217979, Price codes: A20 in paper copy, A01 in microfiche. Geological Survey Water-Data Report C0-79-3, April 1980. 438 p, 4 Fig, 4 Tab, 40 Ref.

Descriptors: *Colorado, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Dolores River basin(CO), *Green River basin(CO), *San Juan River basin(CO).

Water-resources data for Colorado for the 1979 water year consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs, and water levels and water quality of wells and springs. This report (volumes 1, 2, and 3) contains discharge records for about 460 gaging stations, stage and contents of 22 lakes and reservoirs, 4 partial-record low-flow stations, 93 crest-stage partial-record stations, and 200 miscellaneous sites; water quality for 143 gaging stations and 130 miscellaneous sites; and water levels for 55 observation wells. A few pertinent stations in bordering States are also included in this report. The records were collected and computed by the Water Resources Division of the U.S. Geological Survey. These data represent that portion of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Colorado. (USGS)
W81-00671

8. ENGINEERING WORKS

8A. Structures

SCREENS FOR WATER INTAKES,
Beaudry (E.) and Cie, Paris (France). (Assignee).
P. Jackson.
U.S. Patent No 4,192,749, 7 p, 3 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 992, No 2, p 629, March 11, 1980.

Descriptors: *Patents, *Intakes, *Filters, *Aquatic animals, Preservation, Powerplants, Channels, Intakes structures.

A screen for a water intake has a moveable filter element and a recuperation channel adjacent the filter element arranged below the lowest water level. The concavity of the recuperation channel faces the filter element. Suction is applied at the recuperation channel to cause an opposite circulation of water through the filter element at this point. The recuperation channel acts as a safeguarding device for living elements in the water and the opposite circulation of water at the channel detaches living elements from the filter element without traumatism and urges them into the channel. The channel is provided with a filter spaced from the filter element for preventing living elements being entrained by the filter element and carried to the air. (Sinha - OEIS)
W81-00520

HYDRAULIC LABORATORY TECHNIQUES.
Water and Power Resources Service, Denver, CO.
Available from Supt. of Documents, GPO, Washington, DC 20402. A Water Resources Technical Publication, 1980. 228 p, 83 Fig, 3 Tab, 50 Ref.

Descriptors: *Hydraulic models, *Laboratory tests, *Hydraulic engineering, Fluid mechanics, Hydraulic similitude, Spillways, Settling basins, Outlet works, Canals, Rivers, Hydraulic structures, Closed conduit flow, Pumps, Hydraulic turbines, Open channels, Free surfaces.

A guide to applying engineering knowledge to hydraulic studies is presented, based on 50 years of research and testing experience at the Bureau of Reclamation, now renamed the Water and Power Resources Service. Emphasis is placed on basic principles of similitude; techniques of model design, construction, and operation; equipment; and field studies. Individual chapters cover: laboratory equipment; instrumentation; model design; laboratory studies; free-surface flow, spillways, stilling basins, and outlet works; canal structures and river channels; problems of free-surface flow; closed-conduit flow; control of flow; pumps, turbines, and energy absorbers; and field studies. (Moore - SRC)
W81-00566

EXPERIENCE IN OPERATING THE DEEP-SHAFT ACTIVATED SLUDGE PROCESS,
Anglian Water Authority, Huntingdon (England). Essex Sewage Div.
For primary bibliographic entry see Field 5D.
W81-00583

NEW FACILITIES INCREASE CAPACITY, IMPROVE EFFICIENCY,
Louisville Water Co., KY.
F. C. Campbell, and K. W. Cosens.
Journal of the American Water Works Association, Vol 72, No 10, p 558-563, October, 1980. 7 Fig.

Descriptors: *Municipal water, *Treatment facilities, *Construction, Intakes, Conduits, Pumping plants, Costs, Control systems, Remote control, Water treatment, Design, Construction costs.

A study of the water needs for Louisville, Kentucky in 1967 indicated that the building of a second raw water intake and treatment facility would be a better step than continued enlargement of the existing facility. As a consulting engineering firm recommended, the raw water intake and pump station were built to accommodate a 120-mgd flow with no stress, providing space for future pumping capacity up to 200 mgd. The river intake, intake conduits, and raw water pumping station cost $9,939,000. Descriptions and illustrations are given of the intake crib, raw water conduits, and the raw water pump station. Control operations are manually started except for chlorination and screen washing. The control room is situated at the pump station. The plant has been operating for three years with one three-day interruption in service, brought about by the flooding of the mechanical room caused by rupture of a ball valve on the chlorine injection system. The system was redesigned to prevent this problem recurring. The plant should be able to function well beyond the turn of the century before the need for expansion arises. (Baker-FRC)
W81-00594

8E. Rock Mechanics and Geology

STRUCTURE CONTOUR MAP OF THE TOP OF THE MADISON GROUP, LEWISTOWN 1 DEGREE BY 2 DEGREE QUADRANGLE, NORTH-CENTRAL MONTANA,
Geological Survey, Billings, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W81-00655

8G. Materials

SEWER GROUTS AND HOW TO USE THEM.
American City and County, Vol 95, No 1, p 39-41, January, 1980. 1 Fig.

Descriptors: *Grouting, *Sewers, *Infiltration, *Inflow, Pipes, Leakage, Waste water treatment, Treatment facilities, Chemical grouting, Sealants, Safety, Toxicity, Costs, Repairing, Maintenance.

Internal sealing of leaky joints and pipe fractures to prevent infiltration and inflow of unplanned non-sewage flow into sewers may best be achieved through chemical grouts. Grouting of sewer joints has been done in this country for the past 20 yrs. Use of grouting compounds has reduced the cost of sewer repair and maintenance. The two types of sewer grout available, the acrylamide form and an elastomeric urethane prepolymer, are both toxic in their uncured state. When correctly used, both are virtually non-toxic in their cured form. Precautionary measures to be followed in handling the acrylamide form include the wearing of protective clothing to avoid eye and skin contact and inhalation and the storing of grout in a protected location. Elastomeric grout is flammable, is a mild skin and eye irritant, and should not be inhaled. An insert on the hazards of acrylamide is included. The application of each type is discussed. While the cost per unit is similar for each grout, it has been noted that smaller amounts of the eleastomeric material are needed. A Montgomery County, Ohio sewer rehabilitation project quoted a cost of $5.79/joint sealed with acrylamide grout. Manufacturers of elastomeric grout quote the grouting of an eight-inch joint with the urethane foam at just over $4.00 and claim that acrylamide costs double the Montgomery County price. No grout available today can be used on house laterals. (Baker-FRC)
W81-00728

8I. Fisheries Engineering

ENTRAINMENT OF ICHTHYOPLANKTON BY IRRIGATION WITHDRAWAL SYSTEMS,
Fish and Wildlife Service, Vancouver, WA.
W. R. Nelson, and L. G. Beckman.
Report FWS/OBS-79/16, 1980. 44 p, 5 Fig, 7 Tab, 22 Ref, 2 Append.

Descriptors: *Irrigation engineering, *Reservoirs, *Plankton, *Fry, *Fish eggs, Missouri River, Fish conservation, Entrainment, Intakes, Fish reproduction, Irrigation permits, Bays, Seasonal, Depth, Flow rates.

The use of Missouri River reservoir water for irrigation was generally neglected until the drought of the mid-1970's. Many of the irrigation intakes were installed in shallow areas of embayments where the potential for entraining ichthyoplankton was substantial. This study was designed to: determine the potential for entraining ichthyoplankton by synthesizing the location and number of irrigation structures with knowledge of the reproductive characteristics of Missouri River fishes; develop methodology to sample irrigation pump effluents and determine the extent of ichthyoplankton entrainment; and, evaluate and update the present guidlines for intake system permits. Pumps were operated in Swan Creek embayment to determine the effect of location and depth of intake on entrainment. One system was operated at a shallow site in the upper reaches of the embayment with the intake about 1.5m deep and the other located at a deep site near the embayment mouth with the intake about 5.1 deep. Each pump was operated at flows of 3.4 cu m/min and 5.5 cu m/min weekly during May and June and biweekly during July and August. About 12 times more larval fish and 840 times more fish eggs were entrained at the shallow site than at the deep site. Entrainment of larvel fish was greatest during May and June and decreased to low levels in July and August. Recommendations are made on how entrainment of ichthyoplankton by irrigation systems can be minimized. (Moore - SRC)
W81-00560

OXYGEN TRANSPORT IN SALMON SPAWNING MEDIA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
R. A. Johnson, and R. F. Carlson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-142119, Price codes: A02 in paper copy, A01 in microfiche. Project Completion Report No 77-7, September, 1980. 9 p, 3 Fig, 1 Tab, 8 Ref. OWRT-B-039-ALAS(2), 14-34-0001-8057.

Descriptors: *Fish eggs, *Fish hatcheries, Fish populations, *Salmon, *Spawning, Fish, Aquatic animals, Aquatic life, Commercial fish, Marine fish, Marine animals, Fish handling facilities, Fish management, Fish reproduction, Research and Development, *Oxygen demand, Oxygen requirements, Design, Engineering, Life cycles.

Transport of sufficient oxygen to the salmon egg capsule to sustain its metabolic growth is critical to fish egg survival. In this study, measurements were confined to collecting data relating to interstitial flows, which related to both hydraulic head loss and dispersive effects in media comprised of either plastic saddles or gravel. Pressure loss data provided a basis for testing the accuracy of the Ergun equation, needed as part of the oxygen-transport predictive model. It was concluded that the Ergun equation could be used to correlate head loss with apparent velocity. A key conclusion was that head loss for the saddles was much less than for the gravels at a given flow rate. That dispersion coefficients for the river gravels were about three-fold greater than for plastic saddles at a given approach velocity, indicated the former have higher mixing efficiencies. Mixing efficiency appeared to peak at intermediate flow velocities for the river gravel, suggesting an optimal regime for mixing. The observations can be used in hatchery design to assist decision for the use of gravels or saddles as incubation media, and for proper flow velocities. (Zielinski-IPA)
W81-00676

10. SCIENTIFIC AND TECHNICAL INFORMATION

10B. Reference and Retrieval

GUIDE TO THE NATIONAL POWER PLANT TEAM'S BIBLIOGRAPHIC DATA BASE,
National Power Plant Team, Ann Arbor, MI.
H. A. Handwerger, and K. A. Gilden.
Report FWS/OBS-80/06, March 1980. 50 p, 2 Append.

Descriptors: *Data collections, *Electric powerplants, *Environmental effects, Libraries, Water resources, Indexing, Wildlife, Construction, Data storage and retrieval.

Today the need for an ever-increasing supply of energy is coupled wih a concern for the protection of the environment and it is imperative that decision-makers and concerned citizens be aware of the costs and benefits of electric power generation. The National Power Plant Team (NPPT) has a library and a bibliographic data base which provide current information on these issues. This guide to the data base facilitates the transfer of information to those who need it, and describes the procedures for accessing the NPPT computerized library. A list of terms used in subject indexing is provided. Subjects covered by the data base include: power plants in general, their effect on the environment, construction and operation, advanced fuels and materials, and power resources. The library has in excess of 1,000 volumes dealing with the impacts of steam electric power plants on aquatic resources. (Moore - SRC)
W81-00561

10C. Secondary Publication And Distribution

A BIBLIOGRAPHY OF STREAM ALTERATION (CHANNELIZATION),

Clemson Univ., SC. Dept. of Entomology and Economic Zoology.
T. R. White, and R. C. Fox.
Available from the National Technical Information Service, Springfield, VA 22161 as PB81-131120, Price codes: A04 in paper copy, A01 in microfiche.
Water Resources Research Institute, Clemson University, Technical Report No 87, Volume II, May, 1980. 57 p, 836 Ref. OWRT-A-037-SC(1), 14-34-0001-9043, 14-34-0001-8043.

Descriptors: *Bibliographies, *Reviews, *Streamflow, *Alteration of flow, Channel flow, Aquatic environment, Stream stabilization, Documentation, Information retrieval, Channel improvement, Streams, Publications, Research and Development, Streamflow forecasting, Routing, Flow, Stream improvement, Channel erosion, Channel morphology, Distribution patterns, Channelization.

The detrimental effects of stream channelization were increasingly realized by environmentalists and the general public in the past two decades. Evaluation of these effects with respect to all flora and fauna is required to determine how best to preserve our streams and maintain them as important food chain producers. Research results on stream alteration have been most commonly published as government or other public agency reports, which has made papers difficult to find and has led to uncertainty concerning the actual research accomplished on stream alteration. This bibliography, covering over 800 references, was developed to address this research information need. The citations are arranged alphabetically by author, and not grouped by physical or geographical classifications. (Zielinski-IPA)
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